Aviation Week

Including **Space Technology**

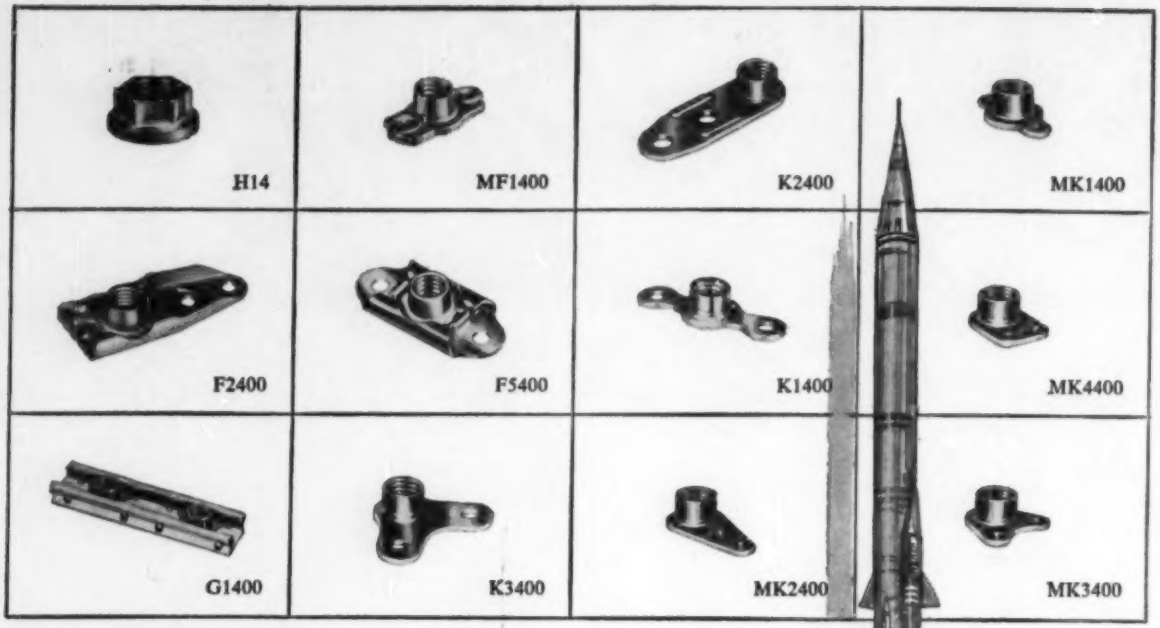
July 20, 1959

Pilot Report On Nibbio F.14

•

Weather System Team Is Chosen

Northrop T-38 Talon



Here's real

FASTENER POWER

KAYLOCK: 160,000 PSI

It's here...a powerful, new Kaylock line...now a whopping 160,000 psi! Smallest, lightest, strongest all metal self-locking nuts ever made. Tailor-made by KAYNAR for 160,000 psi NAS high tensile short thread screws and bolts.

Latest addition to the KAYLOCK line is the H14 lightweight hex...best wrench clearance for narrow flanges... mightiest lightweight yet!

NEW H14 SAVES MOST IN SPACE • SIZE • WEIGHT

STRONGER—Strength to weight ratios increased up to 210%.

LOWER—Same low height as NAS 679.

LIGHTER—20% to 67% below H10 or NAS679 series hex nuts.

SMALLER—By 2 to 5 socket sizes than standard AN and NAS nuts.

SPACE SAVER—Narrowest flanges. Moves bolt close to load centers for strongest design.

SELF-LOCKING—With patented resilient locking principle.

MATERIALS—Available in carbon steel for 550°F. applications. These configurations also in AMS6304 and A286 corrosion resistant steel.

FOR COMPETITIVE REASONS re-appraise your projects with an eye to "trimming off the fat." Send today for Kaynar's new full-line brochure of 160,000 psi self-locking nuts.

KAYNAR MFG. CO., INC.—KAYLOCK DIVISION

World's largest and oldest manufacturer of lightweight, all metal self-locking nuts. Home office and plant: Write Box 2001, Terminal Annex, Los Angeles 54. Branch offices, warehouses & representatives in Wichita, Kansas; New York, N.Y.; Atlanta, Georgia. Canadian Distributor: Abercorn Aero, Ltd., Montreal, Quebec.

KAYLOCK
All-metal self-locking nuts

Announcing—a completely new transparent material with the strength of stretched acrylic, the clarity of glass and the high heat resistance required by advanced supersonic aircraft....

thermoshield

To appreciate **THERMOSHIELD—new transparent plastic composite by Goodyear Aircraft—consider these three facts:**

1 **Canopies and windshields for supersonic aircraft are subjected to intense aerodynamic heating. Some transparent materials can resist such heat.**

2 **Extreme pressure changes during supersonic flight are calling for enclosure materials of greater structural strength. Stretched acrylic plastics can meet this requirement.**

3 **Canopy bubbles are being designed for optimum performance using compound curvatures. Thus, the enclosure materials must be capable of being formed to contours without losing desired properties. Certain processes fulfill this need.**

Not until now, however, has one product met all three requirements of supersonic flight without sacrifice in optical quality. Its name: **THERMOSHIELD.** ***It was developed and is now being produced by Goodyear Aircraft, a pioneer in the field of stretched acrylics and high temperature laminates.***

Basically, THERMOSHIELD is a three-ply laminate using stretched acrylic as the high-strength inner shell—a heat- and shatter-resistant interlayer designated as Goodyear's "F-3"—and an outside thermal barrier of high-temperature transparent material.

The fusion of these three elements is so complete that there is no visible distinction between layers, and the impact resistance of this new material is so great that even 45-caliber gunfire won't penetrate it—delaminate its plies—or shatter its outer facing.

The result: a major advance in the state of the art.

Now—THERMOSHIELD can extend the temperature limits of transparent canopy bubbles from Mach II to Mach III.

Now—THERMOSHIELD can bring new protection to supersonic aircraft requiring one-piece canopies of compound curvature.

Now—THERMOSHIELD can be used as an impact-resistant barrier for transparent canopies and windshields aloft—or as a face guard for military troops on the ground.

For more information **on this major advance in engineered plastics—write Goodyear Aircraft Corporation, Dept. 916AG, Akron 15, Ohio.**

Thermoshield—T.M. Goodyear Aircraft Corporation, Akron 15, Ohio

ENGINEERED PLASTICS—ONE OF THE PRIME CAPABILITIES OF

GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Litchfield Park, Arizona

Now the Navy has a carrier-worthy jet trainer

For the first time, the Navy can teach its flying cadets to make carrier landings and takeoffs in a basic jet trainer.

The T2J Buckeye trainer has successfully passed the stiff Navy qualification requirements for carrier aircraft. Trials covered a wide range of tests—from shipboard handling... to catapult launching... to touch-and-go and arrested landings.

It now joins the Naval Air Basic Training Command in Pensacola to train future Navy and Marine pilots.

The all-purpose T2J gives the Navy a new dimension in basic training. Now the cadet can train in a jet airplane from primary through basic, including instrument flying, armament handling and tactics, combat maneuvers, and carrier training.

The Columbus Division of North American Aviation designed and is producing the Buckeye. It has a stall speed of under 85 mph, yet can fly at 500 mph. It features North American's new deck-level ejection system—equally effective on the ground or in the air... at any speed. Engine and internal equipment compartments are all waist-high for quick, efficient maintenance.

This jet-age addition to the fleet means a broader, more efficient training program for the Navy's jet cadets ...and better-trained pilots to fly the Navy's advanced supersonic weapon systems.

THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION, INC.

Columbus, Ohio

AVIATION CALENDAR

July 30-31—Sixth Annual Symposium on Computers and Data Processing, Denver Research Institute, Stanley Hotel, Estes Park, Colo.

Aug. 4-5—Second Annual Western Regional Meeting, American Astronautical Society, Ambassador Hotel, Los Angeles, Calif.

Aug. 5-7—William Frederick Durand Centennial Conference on the problems of hypersonic and space flight, Stanford University, Stanford, Calif.

Aug. 9-12—Third National Heat Transfer Conference & Exhibit, University of Connecticut, Storrs, Conn. Sponsors: American Society of Mechanical Engineers; American Institute of Chemical Engineers.

Aug. 11-13—Wright Air Development Center Symposium on Aircraft Structural Fatigue Problems, Dayton Biltmore Hotel, Dayton, Ohio. (Confidential clearance required; must be filed with the Symposium Arrangements Committee, WCO, WADC, Wright-Patterson AFB, Ohio.)

Aug. 12-14—Eighth Annual Conference on Applications of X-Ray Analysis, Stanley Hotel, Estes Park, Colo. Sponsor: Metallurgy Division, Denver Research Institute.

Aug. 17—First National Ultrasonics Symposium, Institute of Radio Engineers' Professional Group on Ultrasonics Engineering, Stanford University, Stanford, Calif.

Aug. 18-21—Western Electronic Show & Convention, Institute of Radio Engineers, Cow Palace, San Francisco, Calif.

Aug. 23—Downtown Baton Rouge Exchange Club's Sky-O-Rama, Baton Rouge, La. Program includes the Blue Angels and military displays, both flying and static.

Aug. 24-26—Gas Dynamics Symposium, American Rocket Society, Northwestern University, Evanston, Ill.

Aug. 24-26—Institute of the Aeronautical Sciences' National Specialists Meeting,

(Continued on page 6)

AVIATION WEEK Including Space Technology

July 20, 1959
Vol. 71, No. 3

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. See panel below for directions regarding subscription or change of address. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Publication Offices, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary. Officers of the Publications Division: Nelson L. Bond, President; Harry L. Waddell, Senior Vice President; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation, including missiles and space technology. Position and company connection must be indicated on subscription order.

Single copies 75¢. Subscription rates—United States and possessions, $7 one year. Canada $8 one year. All other countries, $30 one year.

Second class postage paid at Albany 1, N. Y. Printed in U. S. A. Title registered in U. S. Patent Office.
©Copyright 1959 by McGraw-Hill Publishing Co., Inc. All rights reserved.
Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK including SPACE TECHNOLOGY are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL.
All rights to these names are reserved by McGraw-Hill Publishing Co.

Subscribers: Send correspondence and change of address to Fulfillment Manager, Aviation Week, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, including postal zone number. Enclose recent address label if possible. Allow one month for change to become effective.

Postmaster: Please send form 3579 to Aviation Week, including Space Technology, 330 West 42nd Street, New York 36, N. Y.

A matter of family interest

Pratt & Whitney Aircraft has a "family interest" in what happens to its engines throughout their many years of operation.

When a Pratt & Whitney Aircraft engine leaves our plant it's as good as we can make it. It's built to stay that way if properly serviced, using replacement parts that are exactly the same as original parts.

We are concerned over recent reports of increased use of bogus* replacement parts and the potential hazard they present to the dependable and efficient operation of aircraft engines. Counterfeit parts are difficult to detect. They may look genuine but they could cause trouble.

As the booklet "The Problem of Bogus Parts", published by Flight Safety Foundation, Inc., points out, "Another reason for serious concern is that the airworthiness certificate of your aircraft may be suspended or revoked if bogus parts are used in its repair, overhaul or maintenance."

Protect yourself against the problem of bogus parts by specifying original manufacturer's parts, and by dealing with authorized distributors or reputable overhaul or maintenance agencies. Don't take chances by buying your spare parts from a source which doesn't have a family interest in your engine.

**"The Problem of Bogus Parts," published by Flight Safety Foundation, Inc. A free copy of this informative booklet may be obtained by writing to Pratt & Whitney Aircraft, East Hartford 8, Connecticut, Attention: Service Manager.*

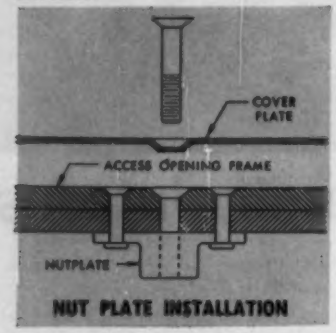
PRATT & WHITNEY AIRCRAFT
East Hartford, Connecticut

CANADIAN PRATT & WHITNEY AIRCRAFT CO., LTD.
Longueuil, P.Q., Canada

Blind Nut*

FIX SAVES THREE DAY DELAY

While an F4D Navy Fighter was in its final position on the assembly line at Douglas Aircraft Company's Torrance location not long ago, a nutplate was inadvertently knocked out in the fuel pump access door structure.

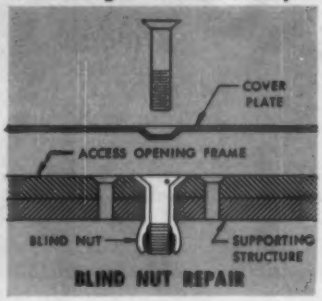


NUT PLATE INSTALLATION

Two men working three days would have been required to install another nutplate in this closed-out structure area since access could only be gained by removal of the fuel pump, fuel cell and adjacent plumbing.

An urgent phone call from Douglas brought a Hi-Shear Rivet Tool Company sales engineer with a portable hydraulic Power Unit and installation Gun to the scene. After the Douglas crew slightly enlarged the dimpled hole, the Hi-Shear man adjusted the Power Unit and Gun and installed a Blind Nut . . . in three minutes!

The fix was accomplished without removal of any equipment of plumbing and the F4D moved on schedule. Since then, Blind Nuts have been used for similar repairs at the Douglas Torrance facility.



BLIND NUT REPAIR

Hundreds of manhours and thousands of dollars have been saved by airframe manufacturers and airlines through the use of stainless steel Blind Nuts and Blind Bolts to replace stripped nutplates, loose rivets, damaged bolts and for modification jobs where the conventional approach would require the removal and reassembly of structural and mechanical components.

BN360 BLIND NUT INSTALLATION

BN359 BLIND NUT INSTALLATION

FIND OUT HOW BLIND NUTS AND BLIND BOLTS CAN SIMPLIFY YOUR FASTENER REPAIRS — WRITE FOR COMPLETE DETAILS.

U. S. PATENT PENDING. FOREIGN PATENTS GRANTED AND PENDING *TRADEMARK

hi-shear RIVET TOOL COMPANY
2600 WEST 247TH STREET • TORRANCE, CALIFORNIA

AVIATION CALENDAR

(*Continued from page 5*)

a symposium on anti-submarine warfare, (classified), San Diego, Calif.

Aug. 27-28—International Commonwealth Spaceflight Symposium, Church House, Westminster, London, England.

Aug. 31-Sept. 2—Annual Army-Navy Instrumentation Program (ANIP) Symposium and Industry Briefing, Statler Hilton Hotel, Dallas, Tex.

Aug. 31-Sept. 5—10th Annual Congress, International Astronautical Federation, Church House, Westminster, London.

Sept. 1-2—Conference on physical chemistry in aerodynamic and space flight, University of Pennsylvania, Philadelphia, Pa. Sponsors: Air Force Office of Scientific Research and General Electric Co.'s Missile and Space Vehicle Dept.

Sept. 2-4—1959 Cryogenic Engineering Conference, University of California, Berkeley, Calif.

Sept. 3-6—National Convention and Aerospace Panorama, Air Force Assn., Exhibition Hall, Miami Beach, Fla.

Sept. 7-13—1959 Farnborough Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.

Sept. 9-11—Sixth Midwestern Conference on Fluid and Solid Mechanics, University of Texas, Austin, Tex. Sponsors: AFOSR/Directorate of Aeronautical Sciences; Office of Naval Research; National Science Foundation.

Sept. 14-15—Titanium Metallurgy Conference, New York University's College of Engineering. For information: Dr. Harold Margolin, New York University, University Heights 53, New York City.

Sept. 16-17—Western Regional Meeting on Frontiers on Science and Engineering, Institute of the Aeronautical Sciences, Los Angeles, Calif.

Sept. 20-25—14th Annual Conference and Exhibit, Instrument Society of America, Chicago, Amphitheater, Chicago, Ill.

Sept. 21-22—Eighth Annual Meeting, Standards Engineering Society, on Investment in Survival, Somerset Hotel, Boston, Mass.

Sept. 21-25—14th Annual Conference & Exhibit, Instrument Society of America, Chicago, Ill.

Sept. 23-24—Engine and Operations Symposium, Airwork Corp., Millville, N. J.

Sept. 28-30—1959 National Symposium on Telemetering, Civic Auditorium and Whitcomb Hotel, San Francisco, Calif. Sponsor: Institute of Radio Engineers' Professional Group on Space Electronics & Telemetry.

Sept. 30-Oct. 2—13th Annual Meeting, Southeastern Airport Managers' Assn., Washington Duke Hotel, Durham, N. C.

Oct. 5-7—Seventh Anglo-American Aeronautical Conference, Institute of the Aeronautical Sciences, Hotel Astor, New York.

Oct. 5-10—National Aeronautic Meeting, Society of Automotive Engineers, the Ambassador, Los Angeles, Calif.

Oct. 6-9—International Symposium on High Temperature Technology, Asilomar Conference Grounds, Monterey Peninsula, Calif. Sponsor: Stanford Research Institute.

Oct. 12-16—15th General Convention of the International Air Transport Assn., Tokyo, Japan.

Crosley

And . . . . . .

Fire Control Systems for the B-52

New and greater responsibilities have been given Avco's Crosley Division by the U. S. Air Force. Long a producer of fire control systems for bombers, including the B-47 and B-66, Crosley recently was named prime contractor for the ASG-15 fire control system on B-52 bombers ordered for the Strategic Air Command.

Crosley now has complete responsibility for engineering, production and performance. Two of Crosley's large plants manufacture, assemble and test complete turrets, computers and radar units for the ASG-15 system that both "searches" and "tracks" to aim the guns that defend the B-52.

In the months and years immediately ahead, many new and ingenious improvements will be made in bomber defense. Crosley already is at work on several, and has achieved remarkable results that will be reflected in the bomber defense systems of the future.

Crosley's extensive experience and technical capability have made it the first name in fire control systems.

For further information, write to:
Vice-President, Marketing-Defense Products
Crosley Division, Avco Corporation,
1329 Arlington Street, Cincinnati 25, Ohio.

OPPORTUNITIES FOR ENGINEERS

Crosley offers excellent opportunities to mechanical engineers with experience in airborne gunnery, and electronic engineers with experience in fire control, radar and servos. Write to: Director, Scientific and Technical Personnel, Dept. W-79E, Avco/Crosley, 1329 Arlington Street, Cincinnati 25, Ohio.

Avco/Crosley

Sikorsky S-62 -a new look in helicopters

OPERATION: From land, water, shipboard, snow, ice, mud—almost anywhere.

RELIABILITY: Million-hour, time-proved components.

ADVANCED DESIGN: Increased payload, higher speed, more cabin space—all for less weight.

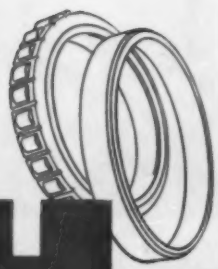
POWER: General Electric T-58 gas turbine, tailor-made for 'copters.

THE NEW LOOK: A sleek boat hull—and smoother, quieter, more comfortable operation—making new 'copter converts everywhere.

SIKORSKY AIRCRAFT, Stratford, Connecticut.
A division of United Aircraft Corporation.

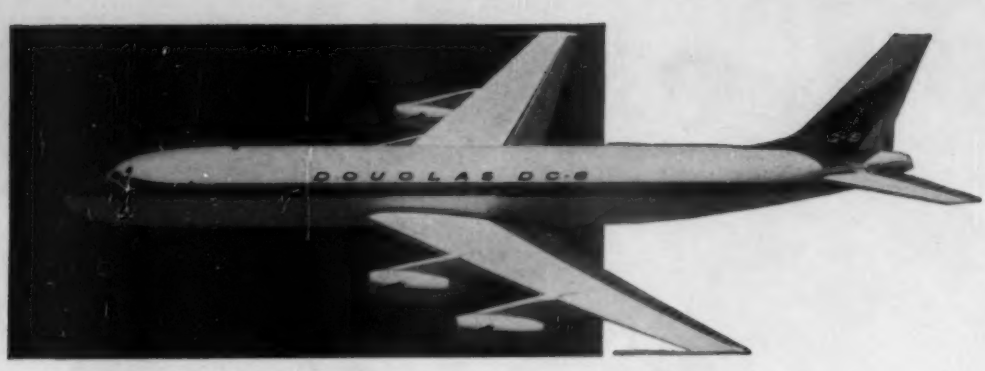
HYATT HY-ROLLS IN P&W JT3 ENGINES HELP THE BOEING 707 SHRINK THE WORLD

HYATT HY-ROLL BEARINGS in each of the 4 Pratt & Whitney JT3 jet engines help the Boeing 707 cruise smoothly at 600 mph. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.



Another GM GENERAL MOTORS contribution to aviation progress

HYATT HY-ROLL BEARINGS FOR AIRCRAFT INDUSTRY



FOR THE DC-8...A FAIL-SAFE A-C SYSTEM

weighing less than this family of 3

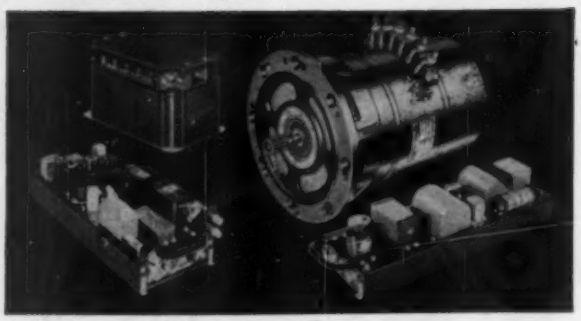
Designed by Douglas and J&H engineers, the DC-8's new a-c power system components weigh, *in total*, just 375 lbs. . . . less than many a family of three who'll board the magnificent jet liner.

This total system contains *four complete electric-power plants*. Each contains equipment ranging from the generator to the current transformers, and each represents the ultimate in reliability. All are so ideally interrelated as to win a "fail-safe" report from editors of the aviation press.

Dramatic success of the DC-8 system through all phases of its development typifies how the J&H organization handles an over-all system project. All research, development and production are conducted at *one location* for maximum team-work, with no lost motion.

Whether your system problem is a-c or d-c . . . aircraft, missile or ground support . . . J&H has the experience and facilities to solve it for you. Check into these capabilities by writing to Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio.

For each DC-8 engine, J&H provides regulator, generator, panel, power relay and other protective and control components.



JACK & HEINTZ, Inc.

SYSTEMS FOR AIRCRAFT, MISSILES AND GROUND SUPPORT

THE NAVY'S POLARIS:

DONNER *helps it think...*

One day soon the U. S. Navy will file a report more fantastic than any sea serpent tale we've ever heard. This will be the launching of the Navy's spectacular Polaris missile from a submerged nuclear submarine. Advanced testing is underway; the Polaris will be ready for the fleet in 1960.

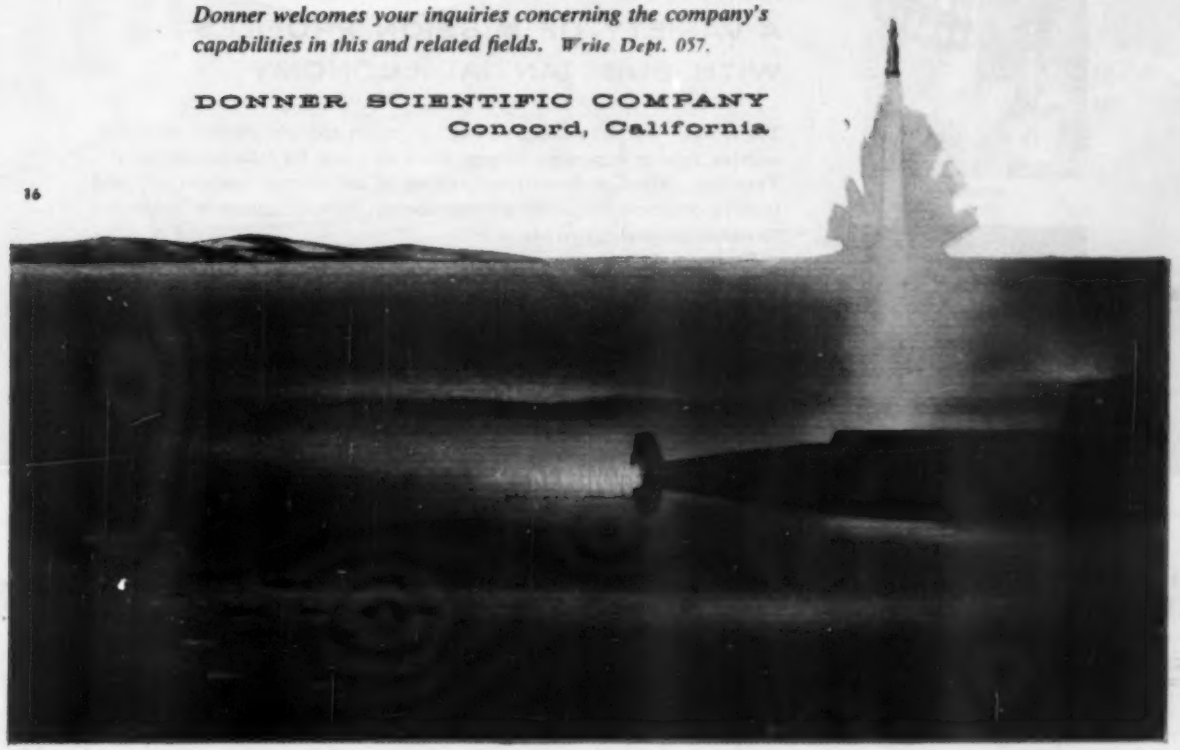
Smaller and lighter than other intermediate range ballistic missiles, this formidable Lockheed developed weapon features much that is new in advanced electronics. It even "thinks" for itself.

One such "think" device aboard the Polaris is a system developed by Donner Scientific Company using as a base a standard Model 4310 Accelerometer. The system monitors flight performance like a policeman directing traffic. If, for example, in the initial portion of the flight, the missile does not achieve sufficient velocity by a pre-determined time, the Donner system aborts the flight. The missile gets the go-ahead only as programmed.

Donner's role in the Polaris project represents another basic contribution from an engineering team which specializes in accurate systems, interlocking time, acceleration, velocity and other inputs designed to meet customers' requirements.

Donner welcomes your inquiries concerning the company's capabilities in this and related fields. *Write Dept. 057.*

DONNER SCIENTIFIC COMPANY
Concord, California



8442-AC

POGO-HI
(II E3c)

P-107
AIR LAUNCHED

P-106
GROUND LAUNCHED

AERONCA TARGET MISSILES PERFORM A VARIETY OF MISSION PROFILES... WITH SUBSTANTIAL ECONOMY

The adage "practice makes perfect" keynotes today's concept of missile warfare. Against supersonic targets, there isn't time for "the second barrel". Therefore, extensive operational testing of air defence systems . . . and training programs for personnel who operate them . . . must be conducted to assure national preparedness.

To accomplish this requirement at minimum cost, Aeronca has developed two expendable, lightweight, high-performance target systems under the Design-Tool-Produce envelope concept. These proprietary missile programs, the P-106 and P-107, are designed for supersonic performance and accurate scoring at all required altitudes, speeds and ranges. ***And their production cost is projected to be substantially less than any current target missile system!***

Another Aeronca-produced missile project is *Pogo-Hi II E3c*. Ground launched to high altitudes, this target utilizes a radar reflective parachute and an infrared emitter package. It is used as "bait" for such current projects as *Nike, Talos, Sidewinder* and *Falcon*.

With integrated Design, Tooling and Production capabilities, Aeronca can produce weapon systems envelopes at either prime or subcontractor levels.

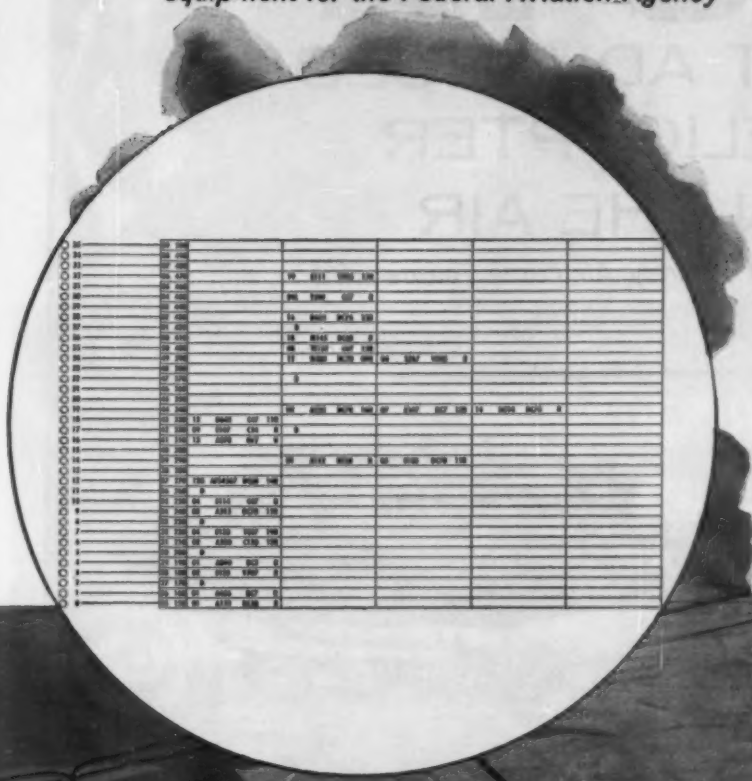
AERONCA manufacturing corporation

1714 GERMANTOWN ROAD • MIDDLETOWN, OHIO

Operational expansion has created openings for additional senior engineers. Write to W. W. Gordinier, Personnel Manager.

GPL systems management

equipment for the Federal Aviation Agency



GPL's contracts for the FAA's experimental data processing central—the heart of tomorrow's air traffic control system—point up the diverse talents required of an effective systems manager.

As prime contractor for this FAA Bureau of Research and Development project, GPL contributes to the design and assumes responsibility for direction, schedules, plans, budgets, and the performances of nine associated companies. Necessary technical capabilities include broad knowledge of air traffic control problems, computers, data handling, radar, communications, human engineering, and "systems thinking" capable of integrating these varied disciplines into a practical, workable system.

The FAA data processing central is but one of a number of current airborne and ground-based programs reflecting GPL's capabilities as systems manager. Supporting these programs are a "systems" oriented technical organization, a "customer" oriented management, and a complete capability from research, engineering, and manufacturing on through to customer service.

The systems management skills of GPL are available to you. Write for further details on the application of these skills to your problem.

GPL Avionic Division/airborne navigators/missile guidance/radar/airborne computers/data handling systems/communications equipment/infra-red/closed-circuit TV.

ENGINEERS — GPL achievements have opened up some unusual research and development opportunities. Send resume to Personnel Director.

ENGINEERING

MANUFACTURING

CUSTOMER SERVICE

RESEARCH / FLIGHT TESTING / ENVIRONMENTAL TESTING

GPL

A GENERAL PRECISION COMPANY

GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N. Y.

A Subsidiary of General Precision Equipment Corporation

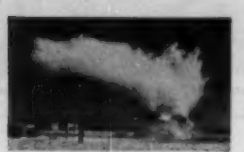
BELL
HU-1A
MOST ADVANCED HELICOPTER IN THE AIR

A Product of Army-Air Force Teamwork

The Army's all-new HU-1A is the first turbine-powered helicopter to be adopted as standard U.S. military equipment. No other helicopter in the world has been so thoroughly tested before being placed in service. The Air Force conducted Phases II, IV and V of the program, augmenting the Army's User Test, Desert Test, and 1000-hour Logistical Support Service Test.

The HU-1A has been praised by airmen everywhere for its simple design and ease of maintenance. In terms of flyability, loadability and over-all performance, it is truly a military man's helicopter.

This already-service-proven helicopter offers outstanding capability in the areas of rescue, utility, missile system supply, and liaison. It is now in production . . it is available.



Icing Test, Ottawa, Canada

Desert Test, Yuma, Arizona

Low temperature test, Eglin Field

Performance and controllability tests, Edwards Air Force Base

BELL HELICOPTER CORP.

FORT WORTH, TEXAS SUBSIDIARY OF BELL AIRCRAFT CORPORATION

SPACE SAVING DESIGN
LOCK HOLDS 27,750 LBS. WITH GEAR COMPRESSED 96% OF STROKE
WESTERN DESIGN developed the X-16 nose gear with a unique "shrink lock" that holds the strut safely compressed under 2.6 times the normal compressed pressure. When gear is dropped, lock automatically releases and strut is fully extended. Steel parts are heat treated 260,000-280,000 psi tensile strength.
More than 50,000 landing gear units have been produced by WESTERN DESIGN, as well as other proven airborne components, assemblies, accessories, systems and ground support and ground handling equipment. Engineering skill, experience and extensive production facilities are available to you.
Call or write today for 28-page facilities brochure.
USI
Western Design
DIVISION OF U.S. INDUSTRIES, INC.
Santa Barbara and Montebello, California
7701 Telegraph Road • Montebello, California • RAymond 3-2611
USI-2-1-59

XXII

This is the twenty-second of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Normalizing Alloy Steels

There are several forms of heat-treatment commonly employed in the processing of alloy steels. Each in its own way modifies the mechanical properties and structures of steel, and each is chosen with a definite objective in mind. The five usual forms of treatment are normalizing, annealing, spheroidize-annealing, quenching and tempering, and stress-relieving.

In this particular discussion, let us consider briefly the purposes and effects of normalizing.

Normalizing is an operation in which the steel is heated to approximately 100 deg F above the upper transformation range, then cooled in still or agitated air. The basic purpose is to refine the prior structure produced by variations in finishing temperatures encountered in rolling or forging. The structure resulting from normalizing, being more uniform, will help create improved mechanical properties when the steel is subsequently reheated, liquid-quenched, and tempered.

There are times when large steel parts (heavy forgings, for example) cannot be liquid-quenched because of their size. In cases of this nature, the heat-treatment must consist of single or multiple normalizing followed by tempering.

High-temperature normalizing is sometimes used for grain-coarsening low-carbon alloy steels to promote machinability. (In high-temperature normalizing, steel is heated to more than 100 deg F above the upper transformation range.) At times it is possible to machine a steel in the air-cooled condition, the governing factor being the alloy content. However, the highly alloyed analyses may require annealing or tempering after normalizing, to decrease the hardness.

It is essential, when normalizing is employed, that free circulation of still or agitated air be provided. When air-cooling of individual bars or forgings is not practicable, the furnace charge should provide for some means of separation, such as racks or spacers.

If you would care to know more about normalizing, or any other phase of heat-treating, you are invited to consult with Bethlehem metallurgists. They have had long experience in such matters, and they know how each treating method affects the various alloy steels. They are always glad to give you any help you need.

And when next in the market, please remember that Bethlehem makes the full range of AISI standard alloy steels, as well as special-analysis steels and all carbon grades. We can furnish what you need.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

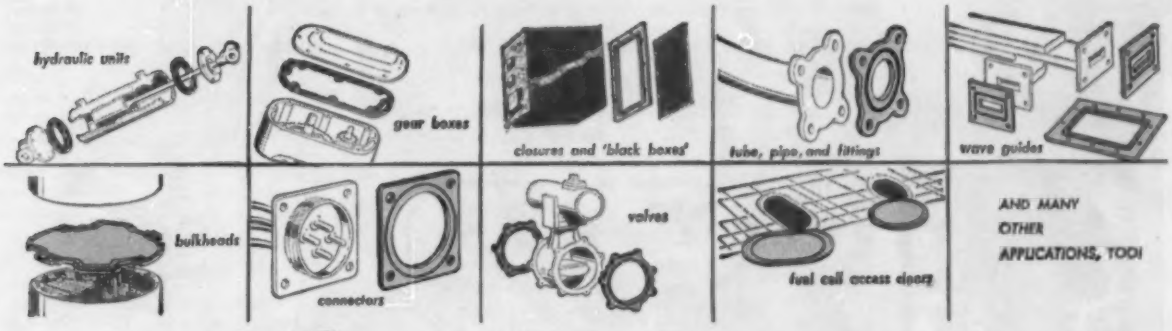
LEAKS *CAN* BE STOPPED!

Controlled Confinement

Safe, sure sealing is vital in today's high performance aircraft, missiles and ground support equipment — and there is a better way to seal them . . . GASK-O-SEALS.

The Gask-O-Seals shown here are static seals that can actually provide sealing that will exceed hermetic specifications. Yet, they are mechanical, can be removed if necessary, and reused. Controlled confinement of the rubber makes them superior to other seals.

The "typical" applications shown are just a few of the ways Gask-O-Seals are being used. Practical, truly economical, no leakage sealing. If you want to seal for sure, find out about Gask-O-Seals. Just drop us a line or use the reader service card.



Parker SEAL COMPANY

CULVER CITY, CALIFORNIA and CLEVELAND, OHIO

A DIVISION OF PARKER-HANNIFIN CORPORATION

UNDUPLICATED

TELEMETERING SYSTEM KNOW-HOW

16 Channel Air Cooled System

High Speed

13 Channel Transistor Missile System & Power Supply

22 Channel Sled System

Standard Subcarrier Oscillator Package

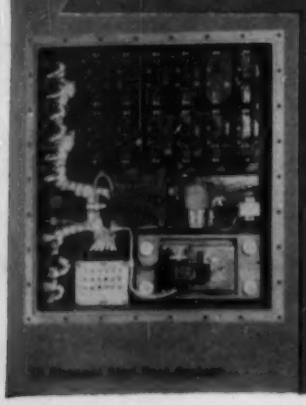
7 Channel Arresting Gable System

10 Channel Transistor Missile System

For the past 14 years Bendix-Pacific has been the major source for telemetering systems and components. This tremendous accumulation of experience — unduplicated anywhere — is your best assurance of the right system for your specific job.

The Bendix-Pacific Systems Engineering Group is always available to discuss your problems and to submit a detailed proposal to meet your requirements. Your inquiry is invited.

TELEMETERING SYSTEMS . . . COMPONENTS . . . RECEIVING STATIONS . . . FIELD SERVICE . . . DATA REDUCTION



10 Channel Package with Heat Exchanger

Bendix-Pacific

DIVISION OF BENDIX AVIATION CORPORATION

NORTH HOLLYWOOD, CALIFORNIA

East Coast (Eastern Representative) Rockefeller Plaza, New York City; Dayton, Ohio, 120 W. 2nd; Washington, D.C., Suite 503, 1701 "K" St., N.W. Canadian Distributors: Computing Devices of Canada, Ottawa 4, Ont.; Export Division: Bendix International, 205 E. 42nd St., New York 20, N.Y.

July 20, 1959

Aviation Week

Including Space Technology

Vol. 71, No. 3
Member ABP and ABC

EDITORIAL OFFICES: New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Nights LO 4-3035) Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630 Los Angeles 17—1125 West Sixth St., Phone: HUntley 2-5450 Dallas 1—1712 Commerce St., Phone: Riverside 7-5117 European Office—1 rue du Temple, Geneva, Switzerland, Phone: 32-35-63

PUBLISHER .....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....William Gregory
EUROPEAN EDITOR.....David A. Anderton
WASHINGTON.....Cecil Brownlow
NEW YORK..Robert I. Stanfield, Harry Raven, Herbert J. Coleman
LOS ANGELES..Irving Stone, Richard Sweeney, Russell Hawkes, William S. Reed
DALLAS.....Craig Lewis
ENGINEERING..J. S. Butz, Jr., Michael Yaffee
AVIONICS...Philip J. Klass, James A. Fusca
CONGRESS..Katherine Johnsen, Ford Eastman
SPACE TECHNOLOGY.....Evert Clark
TRANSPORT.....Glenn Garrison, L. L. Doty, Robert H. Cook
EQUIPMENT.....Berry Tully
BUSINESS FLYING.....Erwin J. Bulban
ART EDITOR.....Lawrence J. Herb
SPECIAL PROJECTS .....John A. Nammack
EDITORIAL PRODUCTION....Arnold Sherman
ASSISTANT EDITORS....Elizabeth M. Hain, Edith Walford
EDITORIAL ASSISTANTS.....Marjorie Nell, Jerome Bailey, Marjorie Todd

FOREIGN NEWS SERVICE

EDITOR.....John Wilhelm
LONDON.....John Tunstall
PARIS.....Robert E. Farrell
BONN.....Marrie Halltzer
MEXICO CITY.....Peter Weaver
TOKYO.....Sol Sanders

DOMESTIC NEWS BUREAUS

ATLANTA 3.....1301 Rhodes-Haverty Bldg.
CHICAGO 11.....520 No. Michigan Ave.
CLEVELAND 15.....1510 Hanna Bldg.
DETROIT 26.....856 Penobscot Bldg.
HOUSTON 25.....1303 Prudential Bldg.
SAN FRANCISCO 4.....68 Post St.

SALES

ADVERTISING SALES MANAGER
E. P. Blanchard, Jr.
ATLANTA.....R. H. Powell
BOSTON.....A. C. Boughton
CHICAGO and ST. LOUIS.....J. S. Costello, D. C. Jackman
CLEVELAND.....H. P. Johnson
DALLAS.....R. T. Wood
DENVER.....John G. Patten
DETROIT.....R. R. Butera
LOS ANGELES.....C. F. McReynolds, D. T. Brennan, C. A. Ransdell
NEW YORK.....M. J. Storz, J. M. Grinton, J. D. Warth
PHILADELPHIA..J. D. Willis, W. L. Blanchard
SAN FRANCISCO.....William Woolston
PROMOTION & RESEARCH MGR..C. C. Gersna
RESEARCH & MARKETING
Mary Whitney Fenton, Jacqueline Gonnet

BUSINESS

BUSINESS MANAGER.....J. G. Johnson
CIRCULATION MANAGER.....T. J. Lucey
ASST. BUSINESS MANAGER ..W. V. Cockren
PRODUCTION MANAGER.....F. A. Dube

NASA Urges Senate to Restore Funds..... 26
▶ Glennan warns that any sizable reduction in NASA's budget will permit Russia to take space leadership.

Idlewild 707 Mishap Sets Off Probes..... 34
▶ CAB will try to learn why landing gear arm snapped on takeoff, and how airport mobs can be stopped.

United Aircraft to Link Weather System..... 70
▶ Development program's objective is to eventually form an integrated high-speed national military-civil service.

SPACE TECHNOLOGY

NASA Urges Senate to Restore Funds 26
Mercury Tracking Net Team..... 27
Sunflare II Launched 29
Second X-15 to Fly..... 31
Army Develops Saturn..... 33

MISSILE ENGINEERING

Pershing May Be Deployed in Italy... 31
Navy Tests Advanced Terrier..... 79

AERONAUTICAL ENGINEERING

AIA Forecasts Space Developments.. 63
Boeing Tests 520 Gas Turbine..... 97
Production Briefing 67
New Aviation Products..... 103

AVIONICS

FAA Inspects Foreign Navaids..... 51
Plotter Displays Air Defense Situation 53
Radio Device Detects Intruders..... 61
United to Link Weather System..... 70
Filter Center 55

BUSINESS FLYING

Nibbio Is Fast, Maneuverable..... 83
Survey Teams 47G-2, Tellurometer... 89

AIR TRANSPORT

Idlewild 707 Mishap Sets Off Probes.. 34
U. S. Air Cargo Policy..... 30
CAB Examiner Chooses Return Rate.. 36
Trunklines Repeat Need for Rate Rise 36
CAB Ends Viscount Hearings..... 37
Initial Court Ruling Upholds ALPA... 37
Surplus Aircraft Export..... 38
Japanese Line Plans Switch to DC-8s.. 39
Eastern Exonerated on Oversale Charge 41
Aeroflot Improving Sales Techniques. 42
Aeroflot Route Map..... 45
Tu-114 Flight Deck..... 68
Shortlines 47
Airline Observer 47

MANAGEMENT

New York Subcontracting System.... 28
Senate Approves Defense Bill..... 29
Who's Where 23
Industry Observer 23
Washington Roundup 25
News Digest 32
AMC Contracts 81

Calendar 5
Letters 114

EDITORIAL

Space Program in Danger..... 21

COVER: Second Northrop T-38 Talon USAF trainer to enter flight-test program at Edwards AFB, Calif., performs a rollover. The forward underbelly uses body camber as a trimming device to eliminate high speed pitch. Underside of afterbody was designed flat to simplify landing gear door operation, speed brake and access door design, and actuation of horizontal stabilizer. Depression at tailpipes of the two General Electric J85 turbojets, rated at about 2,500 lb. thrust each, helps reduce drag. This aircraft first flew June 12. First T-38, also in flight test, made its initial flight April 10.

PICTURE CREDITS

Cover—Northrop Corp.; 26—Satellite Corp. of America; 33—U. S. Army; 34, 35—Wide World; 42, 43—R. B. Hotz; 53—Fenske, Fedrick & Miller; 68 (top)—United Press; 68, 69—E. J. Bulban; 70—United Aircraft; 79—Convair; 83, 87, 89—Aviamilano; 97, 99—Boeing.

78,953 copies of this issue printed

DYNA-SOAR

Dyna-Soar (for dynamic soaring) is a joint project between the Air Force and the NASA, and is an attempt to solve the technical problems of manned flight in the sub-orbital regions. Advance knowledge on the project indicates how a boost-glide vehicle can operate from the outer fringes of the atmosphere where it can maneuver and be recovered undamaged. Studies show that by varying the original rocket boost, and thus the velocity, and with the control available to the pilot, the Dyna-Soar aircraft can circumnavigate the earth, followed by a normal and controlled landing. Boeing Airplane Company, one of the competing companies for the development contract for the complete boost-glide system, has delegated to RCA the responsibility for the development of important electronic components of Dyna-Soar.

RCA

RADIO CORPORATION of AMERICA

DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N. J.

EDITORIAL

Space Program in Danger

The national space exploration and research program has been placed in serious danger by two thoughtless and irresponsible votes in the House of Representatives. The first was a secret vote by the House Appropriations Committee slicing both the regular Fiscal 1960 budget request and the Fiscal 1959 supplemental budget request of the National Aeronautics and Space Administration by $46 million below what both House and Senate had previously authorized. The second was a voice vote by the House upholding a nit-picking legal technicality that deprived NASA of another $22 million for its current fiscal year's program.

These actions by the House members, who only a few months ago were criticizing NASA officials for not seeking more funds and hysterically demanding that the U.S. space program outreach the Russians immediately if not sooner, were punctuated by a pair of Soviet announcements of successful experimental space research rocket shots in which various types of animals were recovered (AW July 13, p. 35). The character, frequency and recovery results of the Soviet animal space shots carry the unmistakable warning of a new stage of advance in their space exploration progress and a strong hint of something even more spectacular to follow soon. In view of all the chest-thumping, outraged indignation and demands for U.S. action in this field that has come from Capitol Hill since Sputnik I went into orbit, it is utterly inconceivable to understand the mental processes by which these supposedly responsible legislators blithely slashed $68 million from a program that has barely begun technically.

Congressional Mandate

As we have pointed out before (AW June 22, p. 69), NASA has done a remarkable job in getting under way since last July when Congress passed the National Aeronautics and Space Act by unanimous vote in the House and an overwhelming majority in the Senate. At that time the Congress demanded:

"The preservation of the role of the United States as a leader in aeronautical and space science and technology."

This was then and still is a worthy purpose.

The initial NASA budget request has been modest considering the magnitude of the task it has shouldered. It requested $485 million for Fiscal 1960 and followed with an additional $45 million supplementary request for Fiscal 1959 to bolster key development areas where progress was promising. Its leaders have been remarkably frank with Congress in warning that this is a bare beginning sufficient only for the organizational and early research phase. They have stated clearly that as the program gathers momentum and produces results it will require as much as $2 billion annually to maintain the pace of leadership demanded by the President, the Congress and the American people. Keith Glennan, NASA administrator, who has a reputation as a hard-headed, able administrator and certainly cannot be confused with the wildly imaginative "space cadet" type, has made a cold, detailed analysis of how these budget cuts which are relatively small in dollars will undermine the pace of the key programs aimed at laying a sound foundation for future space exploration and capturing the lead in this endeavor, now unquestionably claimed by the Soviet Union. Mr. Glennan's analysis is reported in detail on page 26 of this issue. He is strongly supported in his position by Senate Majority Leader Lyndon Johnson (D.-Tex.).

Wavering Support

The current mood of the House in capriciously whittling "across the board" percentage cuts from almost every phase of NASA operations and nit-picking over the wording of a legal clause is all too typical of the wavering support of technical programs in both military and civil research that has put this country in the unenviable position of losing leadership in some critical fields and watching the gap close in others with alarming rapidity. It is the type of muddle-headed action that dooms long term technical programs to inevitable financial and administrative frustration because of a series of short term "whim of the moment" decisions by responsible government agencies both in the executive and legislative branch of the government. It is there, and not with our scientific and industrial leaders, that any responsibility should be firmly fixed.

How indeed can a congressman who has voted for these piddling dollar-wise but technically critical NASA budget cuts look squarely into the eyes of a Project Mercury space capsule pilot who has unhesitatingly volunteered to risk his life facing the uncharted dangers of the unknown for the benefit of his country and all mankind? We wish to exempt from this charge of irresponsibility the members of the Senate and House Science and Space Committees who have worked so hard and effectively to establish and support a national space program.

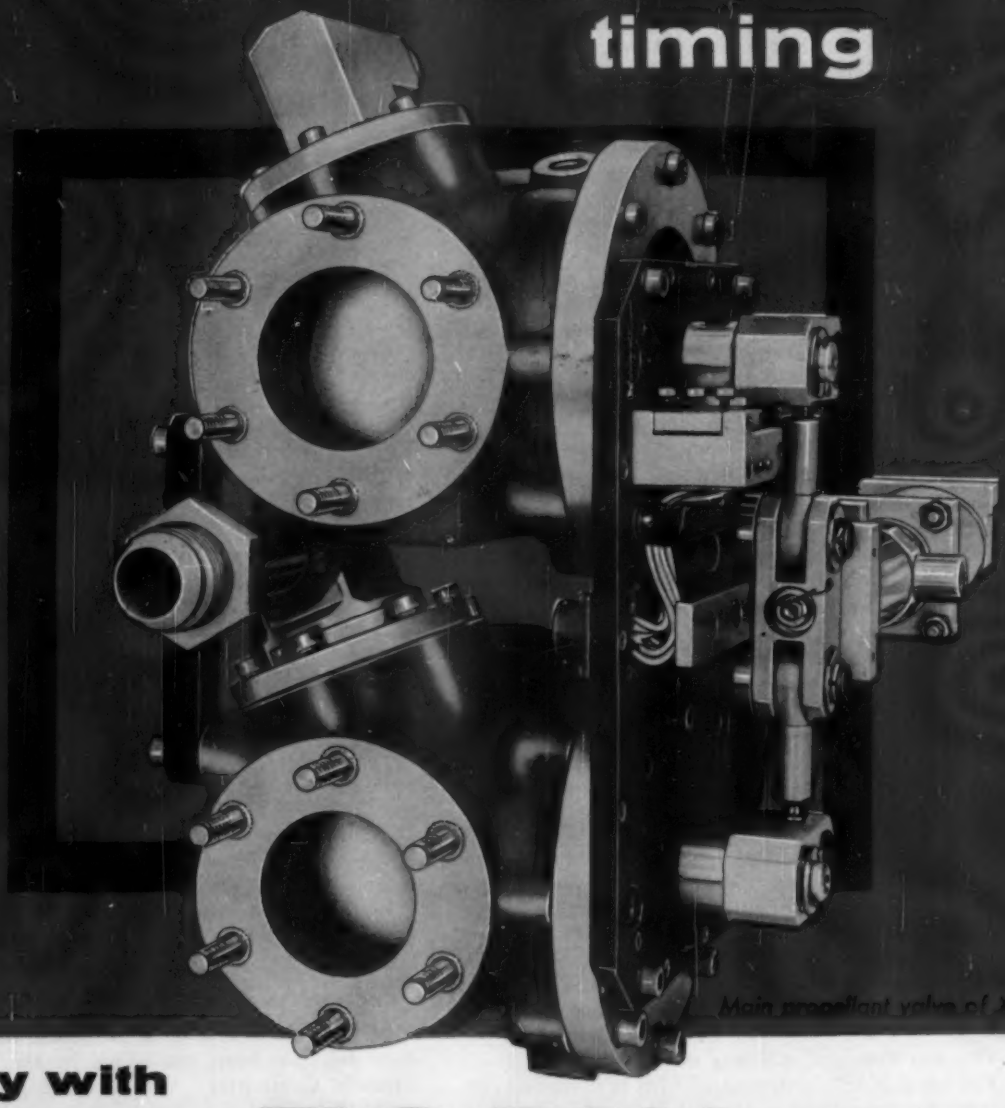
Senate Decision

Now the decision is up to the Senate where the NASA fiscal bills are being considered by the Senate Appropriations Committee. We hope this group will take a more thoughtful and responsible approach to the problem and restore all of the House-inflicted cuts. This will not only enable NASA to continue a brisk pace in its key projects but will also serve as adequate notice to the thousands of young scientists and engineers who might be attracted to this program that the Congress of the United States means what it says and that they can look forward to reasonable support if they devote their technical lives to this fascinating endeavor.

If the Senate and a joint conference do not take this vital action, the national space program will be in serious danger and the full blame for this country's failure to wrest leadership in this field from the Soviet Union must be placed squarely where it belongs—on the legislators who voted against it.

—Robert Hotz

Perfect propellant timing



Main propellant valve of X-15

...only with Hydromatics *FLO-BALL* valves!

From sleds to satellites... Hydromatics makes them all! One actuator drives a precision, mechanical linkage, insuring simultaneous and constant control over both propellants. Hydromatics dual propellant valves are proven in all major missile and rocket systems for service with LOX, Liquid Hydrogen, RFNA, JP-4, Ammonia, and Alcohol at pressures up to 10,000 psi.

Whatever your problem in flight or ground support equipment, Hydromatics has the valve for you.

Hydromatics, Inc.

LIVINGSTON, N. J. • WYMAN 2-4900 LOS ANGELES, CAL. • DICKENS 5-6900

FLO-BALL

Exceptional engineering employment opportunities—write today!

Copyright 1959 Hydromatics, Inc.

WHO'S WHERE

In the Front Office

Clyde Williams, vice president and treasurer, Temco Aircraft Corp., Dallas, Tex., succeeding **H. L. Howard.** Mr. Howard, retired, was a director, executive vice president and treasurer, and co-founder of Temco; he is continuing as a director and a consultant.

Maj. Gen. Thomas Randall Rampy (USAF, ret.), a director, Vanguard Air and Marine Corp., Paoli, Pa.

Joseph A. Blake, president, and **Walter H. Dunn,** vice president and general manager, Pacific Alloy Corp., El Cajon, Calif. Formerly Pacific Alloy Engineering Corp., the company is now a subsidiary of Electric Steel Foundry Co., Portland, Ore.

C. M. Martenson, president and general manager, Hydraulic Research and Manufacturing Co., Burbank, Calif., a subsidiary of Bell Aircraft Corp.

David D. Coffin, group vice president-government, Raytheon Co., Waltham, Mass. **T. C. Wisenbaker** succeeds Mr. Coffin as manager of the Missile Systems Division. Also: **Homer R. Oldfield, Jr.,** manager of the Government Equipment Division, elected a vice president; **E. Nevin Kather,** manager of the Microwave and Power Tube Division.

Thomas J. Harriman, vice president, Giannini Controls Corp., Pasadena, Calif. Mr. Harriman continues as director of engineering.

Jack Warshauer, vice president in charge of corporation expansion and development, Telecomputing Corp., Los Angeles, Calif.

Dr. John H. Buck, vice president and general manager of Tatnall Measuring Systems Co., a subsidiary, and Nuclear Systems, a division of the Budd Co., Philadelphia, Pa.

C. Brooks Barnes, vice president and general manager, Waldorf Electronics, Huntington, N. Y.

Col. Horace W. Lanford, Jr., director of the Electronics Production Resources Agency, Office of the Secretary of Defense, Washington, D. C.

Col. Carlos J. Cochrane, Deputy Director of Flight Safety Research, Office of the Inspector General, Norton AFB, Calif.

Honors and Elections

The Air Force has presented the Mackay Trophy for 1958 to the **Tactical Air Command's Composite Air Strike Force** for its air defense patrol mission over the Taiwan Straits. The trophy is presented annually for the "most meritorious flight of the year."

Miss Jerrie Cobb, of Aero Design & Engineering Co., has been voted Woman of the Year in Aviation by the Women's National Aeronautical Assn.

Lawrence Fleming, head of test instrument development at Southwestern Industrial Electronics Co., a division of Dresser Industries, has been appointed assistant director of the Missile/Space Group of the Instrument Society of America.

(Continued on page 95)

INDUSTRY OBSERVER

► Minuteman launch complex at Air Force Missile Test Center is expected to have two to four above-ground launch stands plus an underground silo and a separate assembly and checkout area. As a safety precaution, large solid propellant missiles, including Polaris and Pershing, have their assembly and checkout areas near pads, rather than in the industrial area where liquid rockets are assembled.

► **Suggestion has been made by some Project Mercury pilots that operation of yaw control for the capsule remain a foot pedal function as it is in aircraft, rather than being incorporated in a three-axis sidearm controller. Since ankles will be restrained, toe caps have been suggested. Either downward or upward foot pressure might transmit a signal sufficient for operation of reaction control jets.**

► Advanced Research Projects Agency is interested in establishing feasibility of captive (reusable) powered launch systems for intercontinental and intermediate range ballistic missiles, anti-ICBM missiles and space probes. General Electric Co. probably will be first to study this problem for ARPA.

► **New launch site at Cape Canaveral, Fla., for National Aeronautics and Space Administration's Vega vehicle will consist of a strengthened Atlas launch stand and modified Atlas tower and a blockhouse modeled after a newer type blockhouse. Vega uses Atlas as its first stage. Site also should be able to accommodate NASA's Centaur, which also uses an Atlas booster.**

► Project Mercury pilots probably will not actually fly capsules launched on suborbital trajectories by Redstone boosters. They will go through the motions and results will be taped or telemetered for later study.

► **Dyna-Soar (DS-1) project will require guidance, flight control and landing control installations, aeromedical laboratories and runway barriers at several downrange islands of the Atlantic Missile Range.**

► Environmental study contracts in connection with Minuteman ICBM program have been awarded by Ballistic Missile Division to Ralph M. Parsons Co., National Engineering Science Co., Kaiser Engineering and Moffatt-Nichol. Specific subjects of the contracts have not been identified but probably are missile silo and control center.

► **American Bosch Arma is scheduled to run specific tests for Atlas ICBM guidance in sled trials at Naval Ordnance Test Station track at China Lake, Calif. (AW May 12, 1958, p. 92).**

► New Products Division of Corning Glass Works is exploring possible use of Corning's pyroceram high temperature glass-ceramic material for turbine blades. The company believes that when problems in forming the blades stemming from pyroceram's viscosity are solved, it will be possible to supply blades capable of operating at temperatures to 1,500C.

► **Main chute for lowering Project Mercury capsule after re-entry is reefed initially to attenuate shock of opening. Opening shock is about 3g.**

► Bids have been opened by Army Corps of Engineers for initial construction work on two Saturn pads at Cape Canaveral, Fla. Pads are located just north of the Titan complex. They use a common blockhouse.

► **Wright Air Development Center flight instrument panel will be used in the two-place Convair F-106B (AW July 6, p. 54). Sufficient F-106A and F-106B aircraft equipped with the new panel will be available to form a full squadron early next year.**

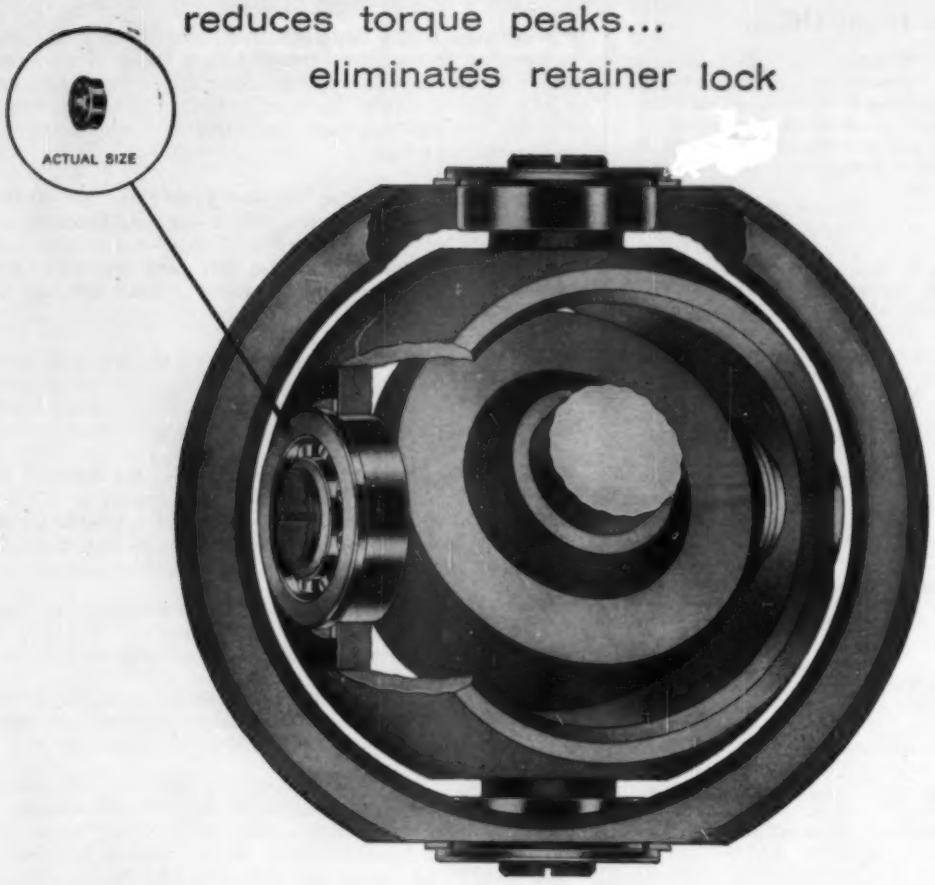
► Drogue parachutes for the Project Mercury capsule have been tested in drops of bomb-like shapes from a Lockheed F-104 at Edwards AFB at speed of Mach 1 and altitude of 60,000 ft. Tests have led National Aeronautics and Space Administration to substitute another material for the nylon used in the chute's long towline because nylon's elasticity allowed the chute to "breathe" in and out rapidly instead of remaining fully open.

Copyright 1959 Hydromatics, Inc.

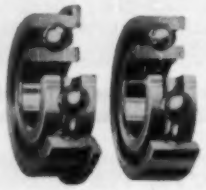
Exceptional engineering employment opportunities—write today!

BALL

BARDEN "W" retainer reduces torque peaks... eliminates retainer lock



Low-torque reliability for gyros, synchros and other torque-sensitive components



"W" retainer bearings are available flanged or unflanged, shielded or open, in sizes most in demand ⅛" O.D. and under. For complete technical information write for engineering data sheet W-1.

An instrument bearing that passes all normal torque tests can develop excessive torque peaks in operation. In gyro gimbals, synchros and similar applications the result is erratic component performance. To solve this reliability problem, Barden developed the "W" ball retainer.

Field tested and proved in actual operation, Barden "W" retainer bearings are specified for a growing number of torque-sensitive applications. • • • *In gimbals on the Sidewinder they contribute to the missile's reliability.* • • • *In attitude gyros they save one manufacturer $100 per unit by reducing costly teardown.*

Like other Barden advances in engineering and manufacturing, "W" retainers answer a specific performance problem. Other Barden Precision ball bearings satisfy such extreme demands as:

- High temperatures (to above 400°F)
- Low torque (to 10 dyne-cm. for 2 lb. load)
- High speeds (to over 300,000 RPM)
- Concentric rotation (to .00005" max. T.I.R.)

The complete Barden line includes sizes from .0469" bore to over 3" O.D., all manufactured to Barden Precision standards of dimensional accuracy, uniformity and reliability. Refer to Sweet's Product Design File (8h/Ba) for Barden catalog and bearing selection guide.

for reliability...specify **BARDEN PRECISION BALL BEARINGS**

THE BARDEN CORPORATION, 41 East Franklin St., Danbury, Connecticut
Western office: 3850 Wilshire Boulevard, Los Angeles 5, California.

Washington Roundup

Holding the Line

Barring a national emergency, the Fiscal 1961 defense budget estimates the Administration will submit to Congress in January will probably be about the same or even less than submitted for Fiscal 1960. Maurice H. Stans, budget bureau director, told the Senate Preparedness Committee in testimony recently released, that it is entirely possible a wholly adequate budget can be developed for the same, or less, than the current budget now under consideration. He said he does not accept the presumption that the 1961 defense budget must necessarily increase. The revised Fiscal 1960 defense budget estimate submitted by the Administration amounted to $39.2 billion, which was boosted another $346 million by Senate action last week and sent to conference committee. However, Democratic leaders, while voting for the bill, criticized the measure as inadequate to meet the nation's defense needs.

Vinson Opposes Incentive Pacts

Rep. Carl Vinson (D.-Ga.), chairman of the House Armed Services Committee, is adamant in opposition to incentive type contracts now extensively used in aircraft and missile procurement. Rep. Vinson unqualifiedly states that they are "basically bad." In addition to stimulating contractors to inflate costs to obtain a premium profit from "savings" effectuated, Vinson says that the contractor is assured his profit at the outset. Rep. Vinson has named himself to head the House representation on a joint House-Senate Armed Service Committee which will soon start a major review of defense procurement.

Retired Officers

Public hearings on allegations of contractor influence in defense procurement being held by the House Armed Services Investigating Subcommittee, headed by Rep. Edward Hebert (D.-La.), will continue through to mid-September (AW July 13, p. 35). When sessions are resumed this week, after a week's recess, the subcommittee will hear from retired high-ranking military officers who have been hired by defense firms. The subcommittee's plan is to hear testimony next from former top civilian government officials now working for defense firms, and then from the industry executives who have hired ex-officers and civilian government officials. The final witnesses will be spokesmen from a few defense industry associations. The subcommittee has sent questionnaires to 30 groups, including Aerospace Industries Assn. and Air Force Assn.

Heliport Survey

U.S. Senate, with an eye on the wide distances between Washington airports once Chantilly Airport in Virginia is opened for operation, has passed a bill authorizing a study covering the construction and operation of heliports in the District of Columbia. The bill assumes that a need for heliports on sites convenient to downtown, government and commercial areas will soon exist—if it doesn't already. Washington National Airport, a convenient distance from downtown Washington, can not handle turbojet transports because of short runways. Baltimore's Friendship Airport—30 mi. away on the other side of the capital—now accommodates turbojets serving Washington, and many observers feel that it will continue to handle at least a portion of Washington flights for some years to come. Chantilly which will be ready for turbojets in 1962, is about 25 mi. from Washington in still another direction. Thus within a few years, Washington will have a triangular airport configuration very similar to the three airports now serving New York, creating a real need for helicopter service. The bill calls for completion of the study by June 30, 1960, at an estimated cost of $25,000.

Another Transport Study

Commerce Department has made another attempt to get another over-all study of transportation under way. It awarded four contracts totaling $73,700 to: R. L. Banks and Associates, Washington, for a study of cost structures of different modes of transportation; J. Harold de Veau, Sumner, Md., consultant, to study historical development of the Merchant Marine, James C. Nelson, economics professor at Washington State College, to study requirements for obtaining government franchises; United Research, Inc., Cambridge, Mass., to study economic regulation under the Federal Aviation Act.

More Top R & D Posts

Action on a proposal to authorize additional supergrade research and development positions in the Defense Department will get underway in the Senate Thursday. Hearings on the proposal were announced by Sen. Ralph Yarborough (D.-Tex.) chairman of the Senate Civil Service Subcommittee. A bill to increase the number of supergrade positions has already passed the House.

Pilot Immunity Gone

Pilots lose their immunity from prosecution under a new procedure for reporting near midair collisions. Federal Aviation Agency has decided to drop its program of voluntary pilot reports of near misses and to follow normal investigative procedures used in handling other safety programs. This switch has the effect of holding pilots responsible for anything they say in such reports, unlike the approach adopted by the Civil Aeronautics Board in February, 1956 in which near miss reports were accepted with the understanding that the name of the pilot and flight identification would be held from any possible prosecution. This was done to encourage candid reporting. Dropping the program eliminates this immunity, and FAA says it intends to pursue near miss reports with particular emphasis on determining the accuracy of the reported facts. Although the FAA action may meet heavy objections from various pilot groups, spokesmen say the old program tended to exaggerate the near miss picture because pilots would often cross-file complaints for fear immunity granted the other pilot might result in charges being filed against the pilot who failed to file. Actual decision to eliminate the voluntary reporting was made jointly with the Civil Aeronautics Board which said the system had yielded all the useful information possible and was not necessary to the Board's air safety regulations.

—Washington staff

Space Technology

NASA Urges Senate to Restore Funds

Glennan warns that any sizable reduction in NASA's budget will permit Russia to take space leadership.

By Ford Eastman

Washington—Any sizable reduction in the National Aeronautics and Space Administration budget will permit Russia to take undisputed leadership in the space technology field, Keith Glennan, administrator, warned Congress last week.

Glennan appeared before a Senate Appropriations Subcommittee to plead for complete restoration of the $68.2 million the House cut from NASA's 1959 supplemental and Fiscal 1960 budget requests.

The cuts would not only hamstring the U.S. space program, he said, but when the already lean NASA budget is sliced at a time when the nation has barely begun its space effort, the world will conclude the U.S. is having second thoughts about facing the Communist challenge in this field.

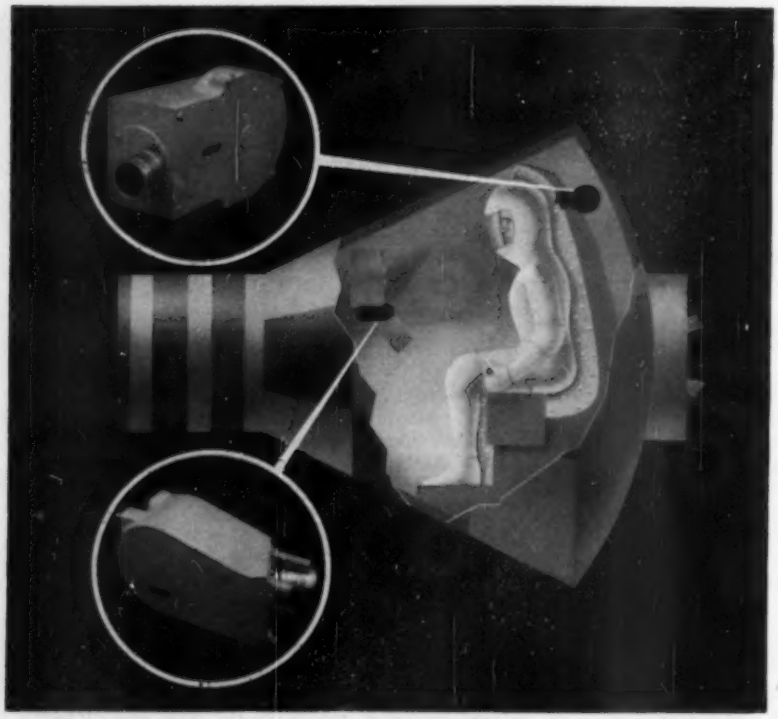
The Administration had requested $485.3 million for Fiscal 1960, plus another $45 million as a Fiscal 1959 supplemental appropriation. The House Appropriations Committee cut the combined requests by $45.5 million, and technical points of order sustained during the debate resulted in a further reduction of $22.7 million (AW July 13, p. 79).

"Wholesale expression of congressional support for NASA was evident until very recently," Glennan told the committee. "Today, the situation is strangely changed, NASA is faced, not with having to decline a plethora of funds, but with the prospect that vital projects will have to be curtailed or even put on the shelf because funds for them are being denied."

Here is what the reduction could mean to the national space program in terms of time and progress, Glennan said:

- **"Development of Vega** rocket propulsion system might have to be drastically cut back. A key vehicle in our future plans, Vega will be capable of placing more than 5,000 lb. in **orbit around the earth.** It will be one of the first space vehicles capable of making extensive television surveys on the moon's surface. It will also be used for communications satellite relay experiments and will have the capacity to launch two-man satellites. It will be our first which is capable of matching the payload lofting capability of the Soviets.
- **"In addition to cutting** back Vega, we might have to retard Centaur, another key space vehicle which will be able to place more than 8,000 lb. in a 300-mi. orbit and should be capable of soft-landing a 730 lb. scientific payload on the moon. The Defense Department, as well as NASA, has a strong interest in this vehicle.
- **"We would have to eliminate** or drastically reduce the $30 million needed for the 1.5 million lb. thrust, single-chamber engine. This is a long lead-time project to provide in about six years time propulsion units capable of 6 million lb. thrust. Only with this vehicle will it be possible to carry our manned expeditions to the moon and back. The budget cut will set this back at least one year."
- **"Among other long lead-time** items on which we would have to reduce the pace is Project Rover, which concerns the development of nuclear propulsion for space travel.
- **"We would have to delay** completing additions to our tracking and data acquisition networks.
- **"Even our top-priority** Project Mercury, the manned satellite project, would certainly be affected if we are to carry on with any semblance of a balanced program. This, of course, would increase the probability of the Soviets scoring still another 'beat' in this aspect of space exploration."

The degree of success, or failure, of the United States space effort as op-



Cameras to Cover Mercury Pilot, Instruments

Cameras to record Project Mercury man-in-space capsule instrument readings and the astronaut's facial expressions during orbital flight have been developed by D. B. Milliken Co., Arcadia, Calif. Camera at top is 16 mm. and is mounted on seat to focus on instrumentation; camera on panel records pilot expressions. Both operate on a trigger pulse of 75-100 milliseconds on 24 v., 0.40 amp. Pilot-observer camera has about 10,000 frames and the instrument camera has about 21,000; tentative plans call for sequencing of one frame every 10 sec. during orbit and three frames per second during launch and re-entry. Cameras will be used in Big Joe and Little Joe preorbital trials and in Jupiter firings.

posed to that of the Russians, Glennan said, will be gravely influenced by what Congress decides regarding the NASA budget.

"The goal all of us seek—U. S. supremacy in space—was set by Congress last year," he said, "and reaffirmed this year when Congress authorized the full NASA budget request. This authorization reflected the awareness of Congress that we cannot win the race in which we are engaged during this turning point in history should we be deprived of the all-out support of our legislators."

Glennan pointed out that during hearings on NASA's Fiscal 1959 budget requests last year, some members of Congress raised serious questions about not having requested far greater sums than the Administration felt was needed to organize NASA and initiate its programs.

"What has happened since then to give anyone a sense of complacency?" he asked. "For I can only interpret the action of the House as an indication of a lessening in the sense of urgency which has been expressed so often on the floor and in committees."

As evidence that NASA's Fiscal 1960 budget has no slack, Glennan told the committee that there is not a single backup vehicle for any of the scientific experiments.

He said each must be a one-shot affair, and if the booster malfunctions, NASA would simply have to lay the experiment aside.

Glennan also said that while the annual budget will grow in the years ahead, it is still his deep conviction that space research holds the promise that it may soon be paying for itself many times over in tangible economic benefits and that the U. S. has every right to count on developments in satellite meteorology, communications, navigation and geodetics which will dramatically affect the lives of all.

A research and development program of the complexity and magnitude of NASA's also cannot be turned on and off at a moment's notice, he said. Having made the decision to enter the race, and for many other important reasons, the U. S. must pursue with vigor an imaginative and well planned program.

Glennan's plea to restore the funds deleted by the House was strongly supported by Sen. Lyndon Johnson (D.-Tex.), chairman of the Senate Committee on Aeronautical and Space Sciences, and by members of the Appropriations Subcommittee.

Johnson said both the Senate and House Space Committees examined the NASA program in every detail and, based on testimony and deliberations, recommended full authorization of the $485.3 million for Fiscal 1960 plus the $45 million for Fiscal 1959 supplemental.

"We all know the importance to our nation of this space program," he said. "It is a new one with many unknown areas. But we cannot afford to be complacent and we must provide our country with the means to be pre-eminent in the field, and I therefore urge the Committee to support the full amount authorized."

Sen. John Stennis (D.-Miss.), chairman of the Senate Space Subcommittee, said he too felt Congress should restore the deleted funds and correct the technicality in language which resulted in the additional reduction of $22.7 million in the House on a point of order (AW July 13, p. 79).

Mercury Tracking Net Team

Washington—World-wide tracking network for Project Mercury will be built for National Aeronautics and Space Administration by a team headed by Western Electric Co.

Project Mercury tracking and ground instrumentation network is expected to cost more than $25 million. Negotiations started last week between NASA and Western Electric on a cost-plus-fixed-fee contract.

Network will include radar tracking and telemetry installations in Africa, South Pacific, Central America, Cape Canaveral, Fla., Hawaii and Southern California, plus a station on an island in the Atlantic, two on islands in the Pacific and two on ships.

Tracking network is to be completed in 1960 and will be designed around existing components. All new stations except the one in the Atlantic will be composed of van-mounted portable equipment which can be redeployed for later phases of Mercury and for other future projects.

Associated with Western Electric as major subcontractors will be Bell Telephone Laboratories for system engineering, engineering consultation and command and control displays; International Business Machines for computer programing, simulation displays and computers; Bendix Aviation Corp. for installation of radar, ground-to-air communications, telemetry and site display equipment, and Burns and Roe, Inc. for site preparation, site facilities, construction and logistics. Western Electric will be responsible for over-all logistics and training and for ground communications.

Vought Will Develop Navy Escape Capsule

Washington—Chance Vought Aircraft, Inc. received a $1 million Navy contract last week for development of an integrated pilot escape capsule for supersonic aircraft.

Vought will design a cockpit section which will allow a pilot to fly without the physical restrictions of oxygen mask, pressure suit, parachute and other survival equipment. Basic capsule design involves a sealed-off, independently pressurized pilot area which will separate from the aircraft in an emergency.

Capsule would be boosted from the aircraft by rockets, stabilized by fins and decelerated by force-sensing drag brakes. At about 62,000 ft. and 500 mph., a first stage parachute would open, then at 14,000 ft. and about 220 mph., a cluster of chutes would open to handle final descent. Capsule will be designed to float and to provide survival equipment for both land, water impacting.

Initial capsule design will be adapted to the forward fuselage of the basic Vought F8U-1 airframe. Company will complete engineering design and evaluation of full scale systems, and scale models will be tested in wind tunnels and in free flight at National Aeronautics and Space Administration's Wallops Island facility.

Soviets Reveal Data On Space Currents

Moscow—Evidence supporting theories that electric currents in space influence the earth's magnetic field has been presented here by Soviet scientists during the International Cosmic Ray Conference. Western participants said that reports on data gathered by a magnetometer aboard the USSR's solar satellite, Mechta, indicated a predicted anomaly in the earth's magnetic field.

A magnetometer was included in the instrument payload of the successful Pioneer solar satellite launched by this country but U. S. scientists say that no information confirming the existence of the magnetic anomaly predicted by these previously unproved theories has been published. According to the data from Mechta, these streams of electric current may be variable in intensity and direction depending on the activity of the sun.

Other highlights of the meeting included presentations by British and Japanese scientists on high energy nuclear interactions. Experiments described showed that the number of pi-mesons produced in nuclear interactions decreases when high energy protons strike other protons or neutrons at speeds exceeding 10^{10}.

New York Attacks Subcontracting System

By Katherine Johnsen

Washington—With the support of the 43 other members of the New York congressional delegation, Sen. Kenneth Keating (R.-N. Y.) last week opened a drive for legislation which would require maximum competition for major weapon system subcontracts and have the effect of breaking up industry teams.

Sen. Keating protested to a Senate Armed Services Subcommittee that at present "there is nothing to stop one multi-million dollar outfit from subcontracting to another corporation, which is also a huge multi-million dollar outfit. The prime contractor has a free hand to subcontract to whomever and wherever he wants.

"With a little mutual back-scratching, several huge corporations can cut up a whole industry and keep the lion's share of the work divided up among themselves in one particular area of the country."

Sen. Keating said that Department of Defense officials have informed him that they have "practically no control over the awarding of subcontracts.

"The prime contractors, not the Defense Department, are the people who really have the biggest say in military procurement," he told the subcommittee.

The New Yorkers previously introduced legislation which would require the competition of at least two firms on all prime contract negotiations (AW June 29, p. 25). Their objective is to capture aircraft and missile business for the labor surplus areas of New York.

The hearings before the Senate Armed Services subcommittee headed by Sen. Strom Thurmond (D.-S. C.) are a forerunner to a major congressional investigation of defense procurement by a joint House-Senate Armed Services group, now being organized (AW July 6, p. 28).

The House representation on the joint committee, named last week, is headed by Rep. Carl Vinson (D.-Ga.), chairman of the House Armed Services, and Rep. Leslie Arends (R.-Ill.), ranking Republican on Armed Services. The other House members are: Rep. Paul Kilday (D.-Tex.); Rep. L. Mendel Rivers (D.-S. D.); Rep. Richard Lankford (D.-Md.); Rep. Toby Morris (D.-Okla.); Rep. William Bates (R.-Mass.); Rep. William Bray (R.-Ind.); Rep. Frank Osmers (R.-N. J.); and Rep. Frank Becker (R.-N. Y.).

The likelihood is that Senate members of the joint group will be members of the Preparedness Subcommittee, headed by Sen. Lyndon Johnson (D.-Tex.), and including Sen. John Stennis (D.-Miss.), Sen. Stuart Symington (D.-Mo.), Sen. E. L. Bartlett (D.-Alaska); Sen. Styles Bridges (R.-N. H.); Sen. Leverett Saltonstall (R.-Mass.); and Sen. Margaret Chase Smith (R.-Me.).

Loose Management

Meanwhile, General Accounting Office focused congressional attention on over-charging of Navy contractors and loose contract management by Navy. A GAO report on spot investigations of 12 Navy contracts over the past year showed excessive costs of $13 million —although contractors were in a position to know the accurate cost estimates at the time of negotiations. A similar GAO presentation on the Air Force, which showed a total over-pricing of $30 million on 14 contracts (AW June 8, p. 26), spurred Congress to turn down all amendments favorable to industry in extending the renegotiation law and start an investigation of the hiring of former military officers and influential government officials by defense industries (AW July 13, p. 35).

GAO criticized Navy, as it did USAF, for its "tendency to accept contractors' representations as to actual costs and estimates of future costs without requiring its contracting officials and the prime contractors to ascertain the correctness and completeness of the cost estimates used in establishing contract prices."

In addition to over-pricing on contracts, the GAO report, presented to the House Armed Services Investigating Subcommittee, headed by Rep. Edward Hebert (D.-La.), also criticized these Navy practices:

• **Allowing a contractor**—Cleveland Diesel Engine Division of General Motors Corp.—the same rate of profit on major subcontracted items as on production in its own plant "even though the contractor would have less responsibility and risk and contribute less effort on the subcontracted work." On major subcontracts for $19.5 million, the GM division was allowed a profit of $2.2 million.

• **Failing to collect** rent from a prime contractor—Bell Helicopter Corp.—for use of government-owned facilities in producing commercial items.

• **Allowing contractors**—Birdsboro Armorcast, Inc.—a profit on rental payments to the Navy and insurance required by the Navy for government-owned facilities used almost exclusively on government work.

• **Allowing a prime contractor**—Philco Corp.—and two of its subcontractors interest-free use of "substantial amounts of government funds for an extended period."

The Navy cases of over-pricing reported by GAO included:

• **McDonnell Aircraft Corp.** In establishing a firm price for F3H airplanes, Navy contracting officials "utilized, without adequate evaluation or verification, cost data which included duplicate costs and costs not applicable to the contract." As a result, GAO said costs were excessive by $2.6 million. Navy has recaptured $1.2 million, and GAO has requested that further action be taken to recapture the remainder.

• **Chance Vought Aircraft.** The target price negotiated on one contract included labor and other overhead costs which were excessive by $1.2 million. Under the incentive provisions, GAO said, these excessive costs resulted in additional cost to the government of $474,000. Although GAO called the matter to Navy's attention, GAO reported to the congressional subcommittee, Navy took no action to recover the excess cost from the contractor at the time of final pricing.

• **Air Arm Division,** Westinghouse Electric Corp. "Excessive costs of

Astrodyne Ownership

Los Angeles—North American Aviation, Inc., plans to acquire the half ownership of Phillips Petroleum Corp. in Astrodyne, Inc., solid rocket engine research, development and manufacturing company presently jointly owned by the two companies.

Plans for North American to take over Phillips' half of the company, located at Air Force Plant 66 near McGregor, Tex., were announced by J. L. Atwood, president of North American.

Details of the arrangements have not been completed. However, Astrodyne would operate under North American's Rocketdyne Division of Canoga Park, Calif., developers and manufacturers of large liquid propellant rocket engines.

Polaris Test Aborted

Cape Canaveral—Apparent failure of the flight control system aborted the 11th test of a full scale Navy-Lockheed Polaris test vehicle last week.

In a component systems test flight, the AX-11 deviated from its course, righted itself temporarily and deviated again after first stage separation.

Second stage then was destroyed by ground control approximately 73 sec. after launch. No complete guidance system has yet been flown in a Polaris test.

$933,463 were borne by the government because the Navy negotiated a price based on estimated costs of $14.8 million, when actual costs of $13.9 million had been incurred "and this information was available to the contractor before negotiations with the Navy were undertaken."

The Thurmond subcommittee heard testimony on three specific procurement bills, each with substantial support:

• **A measure sponsored** by Sen. Saltonstall aims to cut out procurement red tape to achieve speed in the production of advanced weapon systems. It would encourage incentive type contracts, brief "performance" specifications instead of detailed item specifications and weapon systems procurement from a single prime contractor. Defense Department, represented by Perkins McGuire, assistant secretary for supply and logistics, endorsed the general policy of the Saltonstall bill, but qualified that Defense wants a free hand to vary the type of weapon systems procurement and the type of specifications.

• **A measure sponsored** by Sen. John Williams (R.-Del.) would restrict negotiation of contracts. All contracts would be by competitive bid to the lowest bidder unless national security and the need for secrecy or complicated advanced design made this impossible. Negotiations would be reported to the Attorney General. McGuire objected that this measure "would impose a heavy administrative burden on both the Department of Defense and the Department of Justice."

• **The measure sponsored** by the New York delegation contains, in addition to requirements for increased competition in negotiation, policy statements favoring distribution of defense business "to different geographic areas . . ." McGuire, alarmed at the latter aspect, said that it "could reduce the awarding of defense contracts to a struggle among regional or economic groups . . . A supplier's technical capability to produce a complex weapon must not be subordinated to his geographic location."

Senate Approves $39.5 Billion Fiscal 1960 Defense Fund Bill

Washington—Fiscal 1960 Defense appropriation bill totaling $39.5 billion passed the Senate by a 90 to 0 vote last week and was sent to conference with no major changes in the Senate Appropriations Committee recommendations (AW July 13, p. 34).

The Senate bill provides $346 million more than the Administration requested and $746 million more than the House had approved earlier.

Major differences between the two versions to be resolved by Senate-House conferees are:

• **The House deleted** $162.7 million requested for procurement of the Air Force Boeing Bomarc interceptor missile. The Senate restored $79.9 million of the amount requested. Total approved by the House was $2.4 billion and by the Senate, $2.5 billion.

• **For Army procurement** of equipment and missiles, the House voted $1.2 billion. The Senate boosted this to $1.4 billion, provided $117.8 million earmarked for procurement of the Nike Hercules surface-to-air missile is reprogramed for Army weapon system modernization.

• **The Senate boosted** Navy shipbuilding and conversion appropriations from $1.3 billion approved by the House to $1.4 billion, including $380 million for construction of a nuclear-powered attack aircraft carrier. The Senate also reduced funds for anti-submarine warfare from the amount approved by the House.

• **The House approved** $4.1 billion for Air Force aircraft procurement, while the Senate boosted this to $4.3 billion. Funds were included for procurement of 11 Fairchild F-27s, 35 jet utility training aircraft and 14 jet navigation training aircraft.

• **For research, development,** test and evaluation, the Senate voted $1.035 billion for the Army and $970 million for the Navy. This represents a reduction from the amounts approved by the House in both cases. The amount voted for the Air Force was $1.1 billion by both Houses and will not be an issue at conference.

• **The Senate added** language in the bill, not contained in the House measure, which gives the Defense Secretary authority to transfer from one ballistic missile program to another, with certain limitations, for the purpose of adding flexibility.

• **Of the funds available** to the Military Air Transport Service, the House directed that $80 million be made available only for procurement of commercial air transportation. The Senate raised this to $100 million and added language that would make licensed air carriers not holding certificates also eligible to bid for contracts in addition to certificated and supplemental carriers (see p. 30).

• **The Senate also boosted** operation and maintenance funds for the Air Force, Army and Navy over the amounts the House provided.

Nike Asp Launched In Sun Flare Study

Pt. Arguello—Sunflare II, high-altitude sounding rocket to study solar flares, was successfully launched into Pacific Missile Range last week as the first in a series of 12 firings being conducted by the Naval Research Laboratory. Program is supported by a grant from the National Science Foundation.

Purpose of the project is to extend studies on the nature of sun flares and the processes by which the related radio "blackout" is produced, and to measure X-rays and Lyman Alpha radiation. Project is a continuation of a Naval Research Laboratory program conducted from San Nicolas Island in 1957, which found that soft (low energy) X-rays accompany large flares in sufficient quantity to produce absorption of radio waves.

Present program of rocket flare studies at Pt. Arguello is aimed at increasing the scope of information about flare radiations to include the most energetic (hard) as well as the softer emissions. Lockheed Solar Physics Observatory located in the Hollywood Hills advises Pt. Arguello when a sun flare is occurring and a missile is then fired with a 60-sec. countdown, after the range is deemed cleared.

Rockets consist of an Asp coupled to the Nike booster by a separation ring fabricated from ductile cast iron. Nike booster carries the Asp to a height of about one mile, at which point thrust begins to decrease and an acceleration switch ignites two blast caps to break the separation ring thereby freeing the Asp. At approximately 22 sec., the Asp has coasted to a height of 50,000 ft., where barometric pressure switches close the firing circuit.

Asp reaches an altitude of 80,000 ft., with a velocity in excess of 7,000 fps. at burnout, then coasts to a peak altitude of 150 mi. The rocket then falls to earth after a total flight time of 8 min.

Payload weight is 50 lb., which includes scintillation counters, Geiger counters, and ionization chambers to map out the full range of the X-ray emissions and to reveal the development and decay of these ionizing radiations relative to the flare of visible light.

Total weight of the booster is 1,585 lb., and length is 20.9 ft. Standard Army Nike I, developed by Western Electric, is about 12 ft. long, 16.5 in. in diameter and weighs approximately 1,300 lb. with fins and coupling. Atmospheric sounding projectile (Asp), manufactured by Cooper Development Corp., is 107 in. long, 6¼ in. in diameter, and weighs 210 lb., excluding the 75 lb. weight of the instrumentation section, nose cone, and thrust skirt.

Federal Support Mounting Behind National Air Cargo Fleet Concept

By L. L. Doty

Washington—Federal government backing behind plans to revamp basic U. S. air cargo policy continued to mount last week as the U. S. Senate gave its approval to the allocation of $100 million for the movement of military traffic on commercial carriers during fiscal year 1960.

Although the amount falls short of the $150 million originally proposed by a Senate subcommittee, Senate floor debate on the issue disclosed that recent moves to strengthen and modernize U. S. cargo airlift capability are gaining momentum. The proposed $100 million program, a section of the Defense Appropriations bill (see p. 29), goes into joint conference this week.

A significant factor behind the Senate action is the impact a recently-drafted Federal Aviation Agency concept of a national cargo fleet has had on the thinking of government and industry officials in the development of a sound cargo program—a program that could bring a halt to the bitter running battle between the airlines and Military Air Transport Service for heavy shares of military cargo.

Key to the Federal Aviation Agency plan is the development of a cargo aircraft that will fly at direct operating costs of 3.5 cents per ton-mile and operate at 10 cents per ton-mile costs to the shipper (AW May 18, p. 25). Payload should be about 75,000 lb.

Common Cargo Needs

Essentially, the Federal Aviation Agency plan, as expounded by Administrator E. R. Quesada, is based on the theory that low shipping costs will attract new markets. In addition, Quesada feels that both commercial and military cargo are common in dimension and weight characteristics so that one type of airplane will serve all cargo requirements.

The plan calls for a "hard core" military cargo fleet that would be used in direct support of emergency war plans. Routine cargo support would be provided by a commercial cargo fleet in peace and war that would consist of economical and "uncompromised" all-cargo aircraft adaptable to the common military and civil needs.

Quesada has taken the lead in working with industry and other government agencies, including the National Aeronautics and Space Administration, toward the development of an optimum cargo aircraft.

Here is a summary of the support Quesada has recruited behind his plan to develop a joint military-civil cargo plane:

- **Senators** A. S. Mike Monroney (D.-Okla.) and Stuart Symington (D.-Mo.) have urged the Department of Defense to take action toward developing a cargo plane as essential "not only in terms of our specific defense needs but also if we are to maintain our international leadership in commercial aviation." During the recent Senate debate the earmarking of military traffic for commercial carriers, Monroney noted that the bill ". . . is to help the U. S. have an airlift that is a little bit more modern than a wornout DC-3."
- **Civil Aeronautics Board** Chairman James Durfee noted that failure to develop an all-cargo aircraft has caused concern to the Board "because we are of the firm view that the vast potential for air cargo will not be fully exploited until such an aircraft is produced for, and used by, the civil air carriers."
- **Air Force Secretary** James Douglas gave his support to the development of an efficient cargo program and then later noted that "as a long-range objective, subject to the availability of modern, economical long-range commercial cargo aircraft, civil cargo airlift should be contracted for in peacetime to support, to a substantial degree, the overseas logistic supply."
- **Assistant Secretary of Defense** for supply and logistics Perkins McGuire recently stated that the "lack of a pure cargo aircraft is one of the principal limiting factors in the development of the air cargo industry" and that such an airplane would be a significant defense asset.
- **Seaboard & Western Airlines** has proposed a cargo program that has been closely keyed to the Quesada plan. It calls for a fixed tariff to replace the bidding system now used to determine the assignment of military traffic to commercial carriers (AW July 6, p. 25). Recently, the Civil Aeronautics Board termed the exemption principle, which permits carriers to bid against one another for traffic, "destructive."

Carrier Qualifications

In his plan, Quesada does not define the types of carriers which are to be included in his proposed national air cargo fleet. This issue was raised when Sen. Clair Engle (D.-Calif.) introduced an amendment to the appropriations bill that would permit all carriers, including those which do not hold certificates as supplemental carriers, to participate in the $100 million plan.

Quesada has conceived his national air cargo fleet as serving national policy essentially as the Maritime Service has served in the past. He emphasizes that development of an effective cargo fleet which would serve military as well as civil requirements "can be generated outside military budgets, thus avoiding direct competition with weapon systems (procurement)."

In his program, he charged that the "U. S. does not have a capable, effective, economical and responsive air logistics capability to support military operations in a limited war situation."

These views have been echoed by Sen. Monroney, who, in his joint statement with Sen. Symington, had this to say: "Some indication of the inadequacy of the present airlift is indicated by the fact that 42 of 273 available C-124s and weeks of time were required to place a handful of troops in Lebanon, even unopposed, and essential equipment for effective combat capability was still arriving after the withdrawal had been ordered months later. Likewise, some 30 C-124s were required to airlift one small squadron of F-104 fighters to Formosa."

Canadian Breakthrough

Quesada referred to the sale of fleets of Canadair CL-44 turboprop cargo aircraft to Flying Tiger Line and Seaboard & Western under a loan guaranteed up to 80% by the Canadian government as "a technical and financial breakthrough of national consequence." He added: "The operational success of this aircraft will place Canada in an enviable position in the cargo industry throughout the world. The potential air cargo market will, we believe, 'explode' immediately after the introduction of this aircraft."

Quesada warned that the U. S. is in a "most unfavorable position" in the design and manufacture of a true cargo aircraft capable of producing low ton-mile cost to the user and then noted: "It behooves the U. S. government to stimulate by the most appropriate means the development of this capability. It appears likely that given the development of a suitable aircraft, minimum government activity and maximum private enterprise could produce the required capability at the least cost to the taxpayer and the greatest benefit to the nation's economy and welfare."

Here is Quesada's final summary of his plan for a national air cargo fleet:

"We anticipate that government assistance in the area of guaranteed loans and perhaps in contribution to development costs of a suitable aircraft would be all that would be needed to assure the healthy creation and operation of a national air cargo fleet with the ability to foster national objectives on a global basis."

Pershing May First Be Deployed in Italy

By Cecil Brownlow

Verona, Italy—First operational units of the Army-Martin Pershing 800-mi. solid-propellant missile may be stationed behind the mountain passes of northern Italy, manned by forces of the U. S. Southern European Task Force (SETAF).

A number of Army officials at SETAF headquarters here believe that their command will be the first to receive the Pershing because of the relative invulnerability of the area, coupled with the fact that U. S. units trained in missilery already are on hand.

With the Soviet Union and its satellite complex the most probable immediate targets in any war, nuclear or conventional, these officials contend that there are only three logical areas within the North Atlantic Treaty Organization for the establishment of Pershing units—northern Italy, Asian Turkey and the eastern reaches of West Germany. Immediate vulnerability of the latter two to both land and air attack, they contend, should give the SETAF area top priority.

One top SETAF officer says, "northern Italy units could stay alive longer than any other place you can find in Europe and still reach out to an area where we could do major damage."

An 800-mi. arc from probable sites in this area extends beyond Kiev and reaches into Latvia, Lithuania and all of the satellite countries.

As an interim weapon before the emergence of Pershing, officers of SETAF's combat arm, the First U. S. Army Missile Command, hope to receive the 200-mi.-range Sergeant solid-propellant missile to replace its present force of two battalions equipped with 80-mi.-range Corporals.

Missile Command authorities obviously are not happy with the liquid-propellant Corporal. Its commander, Col. Melville B. Coburn, describes it as "an obsolescent if not obsolete piece of equipment. . . . In a way it's like a woman driver. It's all out or stop. . . . You're either bang on the target or else you're liable to be 80 mi. away in the wrong direction."

The Corporal system also is cumbersome, requiring 17 heavy support vehicles, and hardly fits into Col. Coburn's belief that his command must be truly mobile if it is to survive long enough after the outbreak of war to successfully carry out its mission.

To try and make the best of the situation at hand, Col. Coburn's two battalions envision carrying out all but two hours of the necessary 12-hr. checkout and fueling phase for the Corporal at a "hide point" and then trundling the missile to another area for the actual launch. This helps, but 10 of the 17 vehicles still would have to tread their way tortuously over the narrow, mountainous roads of northern Italy from the "hide point" to the launch area.

With sufficient warning, the Corporal could be kept fueled and at the final two hours of countdown for a period of 27-28 days. Within this framework, the countdown time can be further narrowed to 15 min. for two-hour periods before its Gilfillan guidance system has to be checked and corrected to compensate for the effects that outside temperature changes impose on the unit.

Number of vehicles needed for the Sergeant would be considerably less—the three guidance vans needed by the Corporal, for example, would be reduced to one, and the three fueling trucks could be eliminated entirely. Also, it would not be necessary to have the Sergeant guidance van accompany the missile to the actual launch site as in the case of the Corporal. The solid-propellant, longer-range Pershing would have similar advantages.

One positive step the Missile Command is taking toward modernization is the acquisition of Radioplane Division of Northrop Corp.'s SD-1 drones to aid in target acquisition and location. At present, the Corporal battalions rely primarily upon Sky Cavalry units which would operate behind enemy lines locating and radioing back target positions.

Col. Coburn describes the drone as the first step toward gaining the capability of precisely locating a target's position in relation to the missile launcher, a need particularly acute for operations in the mountains of northern Italy where many areas still have not been adequately mapped. Admittedly a first generation system—and Coburn says it "may be flattering the thing to call it that"—the drone promises to give the Missile Command at least some increase in flexibility.

Main drawbacks are limited range—a combat radius of 30,000 to 40,000 yards with its camera payload—and its dependence upon a radar guidance system. Coburn hopes to eventually obtain a drone system that can program its own course without the need for radar.

First of six SD-1s scheduled for the command will arrive in October, and Coburn hopes to have a drone platoon established within his Sky Cavalry company by December.

Over-all, however, the strength of the Missile Command has slipped steadily during the past year, its manpower strength declining from 4,000 to approximately 2,000 at the end of Fiscal 1959. A substantial portion of the cuts resulted from the loss of two 15-mi.-range Honest John rocket battalions which have been replaced by two Italian Honest John battalions trained by, and still largely under the direction of SETAF (AW July 13, p. 104). There also have been cuts in almost every area in order to squeeze the command to within its new force levels dictated by the over-all reduction in Army manpower. They include:

• **Sky Cavalry Battalion** under Coburn's command at the beginning of Fiscal 1959 has been reduced to company size at a loss of 200 men, although its range of capabilities remains essentially the same. Large portion of the Sky-

NATO Missile Units

Paris—Original United States proposal to locate six intermediate range ballistic missile squadrons in Europe under various national commands has now been reduced to four, including two Jupiter squadrons designated for Italy. Other two of four squadrons probably will be located in Greece and Turkey.

All four squadrons will operate under North Atlantic Treaty Organization command and give NATO a substantial strategic capability for the first time. Funds originally scheduled for two squadrons that have been cut from the planning will be funneled into research and development work for follow-on missile systems.

Second X-15 to Fly

Second North American Aviation X-15 rocket research aircraft will have its first captive flight late this week or early next week. The flight will be to test flight controls and systems, especially the fuel dump. The aircraft will carry a full liquid load aboard at takeoff and will dump during the captive flight.

The second X-15 will make the first powered flight, probably several weeks after its first captive flight. This machine was built with all the powerplant hardware intact from the first; hence it will make the first powered flight instead of No. 1 X-15, which was instrumented and aimed at gathering early aerodynamic data in captive flights, free drops, glides and landings, rather than powerplant information.

The first X-15 will be overhauled to make powered flights, probably the first one in September or October.

Cavalry troopers are trained to operate behind enemy lines, feeding back target data by radio. Col. Coburn says that from the experience of training exercises, "we know we can get a team of six to 12 men in and out again before the opposition can react." Primarily, the troopers are flown in by a helicopter skimming close to the ground to avoid radar detection and either picked up again at a rendezvous point or left to work their way back across the lines. The company also includes radar surveillance and aerial survey platoons.

• **Fifth Delivery Unit,** an engineer group with the primary mission of blowing up and destroying by atomic blast the narrow mountain passes leading into Italy in the event of ground attack, also has been reduced to company size with a similar loss of about 200 men. Unit now has a total of three atomic demolition teams.

• **Infantry company** to provide security for one of two Corporal battalions has been replaced by an Italian unit. Security for the second battalion was peviously provided by Italian Army.

• **Signal company,** which in manpower actually had been larger than a battalion and has the duty of maintaining communications with Sky-Cavalry units over an area 100 mi. in depth and 170 mi. wide, has been substantially reduced, along with support and supply groups.

Despite the cuts—and regardless of whether his Corporal battalions are ever called upon to fire a shot—Col. Coburn feels that they and the Honest John units already have played a significant role by giving the Italians a feeling of strength and accustoming them to live with atomic weapons. He says:

"When it was decided to supply Italian units with the Jupiter IRBM, the Communists immediately jumped out, shouting that this would automatically make Italy an atomic target. Their opponents shouted right back that long-range nuclear weapons were already in Italy. The difference in range between the Jupiter and Corporal was insignificant to most of the people. . . . This is the greatest thing we do—we are a manifestation of atomic power . . ."

If he is ever called upon to shoot, Coburn will have two primary problems—mobility and logistics. Since the Soviet land forces would have to come to him, he says his primary duty during the early days of any war will simply be to stay alive. The latter problem, he adds, "is our main vulnerability."

Coburn's first move would be to get his units from their known locations into the mountains and, with as much speed as a ponderous Corporal unit could hope to muster, keep on the move.

The problem of mobility begins at the first sign of an alert since all the married personnel of the units are forced to find living quarters in surrounding villages, some of them a number of miles away. The problem of transmitting the alert plus the distances involved mean that some of the married men have been between three and four hours in arriving at their dispersal areas during maneuvers to test the response capability.

So far as logistics are concerned, Col. Coburn says he sees little need for large stockpiles since he does not have the transport to move it, and "the only pre-stocking that's valuable is that which you can keep mobile and moving around." He would like to see a system worked out whereby he could be resupplied by submarine or long-range water based aircraft where "we could come down out of the mountains, pick up the supplies and get back quickly." He readily admits, however, that he doubts if "we'll ever enjoy this much prestige."

News Digest

Explorer VI radiation satellite launch attempt failed last week when the Juno II launching vehicle rose several feet, tilted sharply, then was exploded above the pad by the range safety officer. Fifty-five men, including Brig. Gen. John A. Barclay, commander of Army Ballistic Missile Agency, and Dr. Kurt Debus, head of ABMA's Missile Firing Laboratory, were in the blockhouse 50 yards northwest of the pad. None was injured. The 91.5 lb. satellite was designed for seven experimental objectives, most of them in the radiation field.

Tu-114 Flight Plan

New York–Soviet Tu-114 turboprop transport last week returned to Moscow, flying the New York-Moscow run in 9 hr. 48 min., or 32 min. less than the 10 hr. 20 min. estimated on the overseas flight plan.

Flight plan filed here listed the turboprop's takeoff weight as 334,400 lb., of which 123,200 lb. was weight of the fuel. Aboard were 65 persons, including the crew. Pilots estimated the true airspeed as 406 kt. at 33,000 ft.

Route filing was Idlewild-Boston-South Portland, climbing to 30,000 ft. on that leg; and then to Yarmouth, Dartmouth, Copper Lake and Sidney, the ocean intersection at Newfoundland to Gander, at 30,000 ft. From Gander, the Tu-114 climbed to 33,000 ft., flying to Keflavik, Faroe Isle, thence to a point 61 deg. 32 min. north and zero deg. west, on to Flesland, Oslo, Aker, Ventstils, Riga, Velikiye Luke, and Moscow.

Identified as Aeroflot 5611, the plane flew the 5,092 mi. nonstop route to New York in 11 hr. 6 min. (AW July 6, p. 38).

Harry J. Goett has been named director of National Aeronautics and Space Administration's Goddard Space Flight Center at Greenbelt, Md. A veteran of 23 years with NASA and the National Advisory Committee for Aeronautics, Goett is currently chief of the Full Scale and Flight Research Division at Ames Research Laboratory. He joins the Goddard facility Sept. 1.

Russians have again fired two dogs into space and recovered them successfully, according to Tass, official Soviet news agency. Tass also said a quantity of equipment was parachuted back to earth. Rocket weighed 4,845 lb., apparently about the same size as the previous launch (AW July 13, p. 35). The agency said instruments measured radiation and cloud masses were photographed.

Radiation, Inc., Florida Division has received a $4 million contract from Boeing Airplane Co. to manufacture an advanced digital telemetering system for Minuteman intercontinental ballistic missile program.

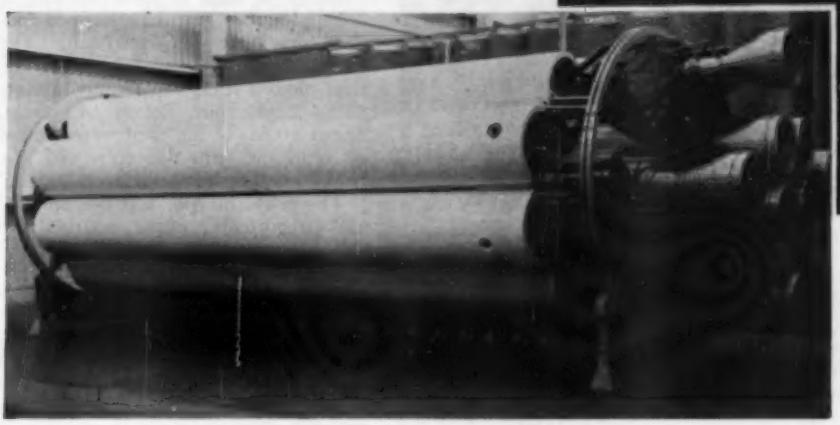
United Aircraft Corp. will spend $68 million this year and next for expansion and modernization of production and research facilities, with a major share of the expenditures in United's Connecticut plants. Company will spend $39 million for research and development facilities, and another $29 million for production facilities. United also said a "substantial share" will be spent at the Research Department at East Hartford, Conn., and at United Research Corp. of Menlo Park, a California subsidiary.

Douglas Aircraft Co. last week reported a first half net loss of $15,010,000 due to a renegotiation refund of $2,867,000 combined with higher costs than anticipated in production of the DC-8 jet transport. Donald W. Douglas, president, noted that DC-8 costs in the first half were $17,730,000, a drop of $10,159,000 under a year ago but explained that heavier production costs forced inventory write-downs of $21,240,000 against $6,934,000 for the same period last year. Company appealed the renegotiation payment.

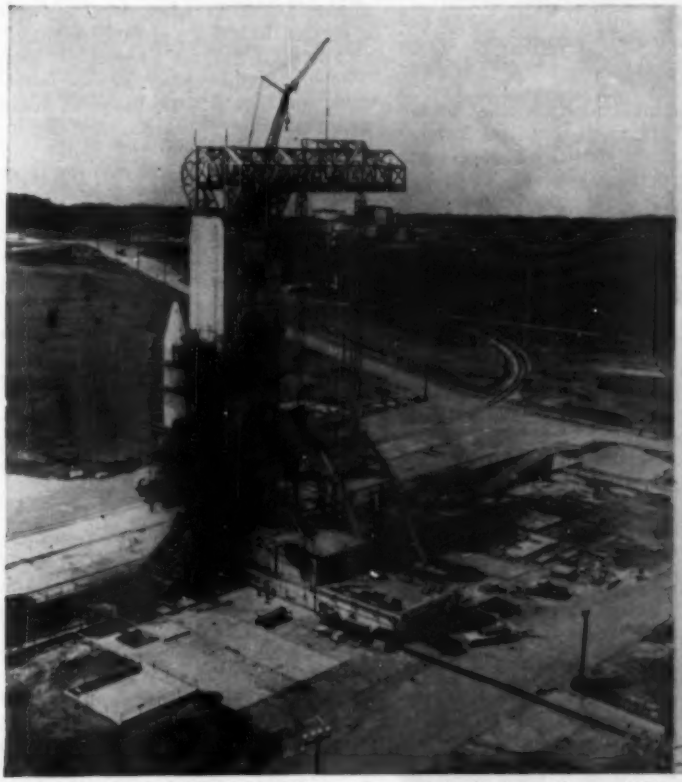
Civil Air Transport of Taipei, Taiwan, has purchased a Convair 880 intercontinental Model 31 turbojet transport for delivery in November, 1960.

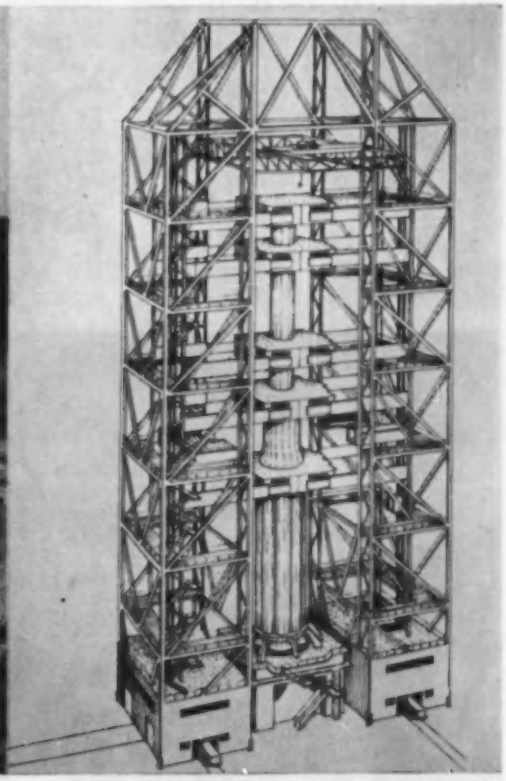
Army Develops Saturn For Space Applications

Saturn three-stage vehicle (right) will weigh about 580 tons at launch and about 500 tons of this launch weight will be propellant fuels and oxidizers. Vehicle will stand 200 ft. high. Modified Titan second stage (AW July 6, p. 23), will be somewhat longer than normal 54 ft. and will be 10 ft. in diameter. Centaur third stage will be 10 ft. in diameter.



Saturn first-stage booster (model at left) will have eight Rocketdyne H-1 engines. It will be about 75 ft. high and 22 ft. in diameter. First-stage cluster will be static-tested on tower (below, left) at Redstone Arsenal and will be flight-tested from Atlantic Missile Range where a 305-ft. self-propelled service stand (below, right) will be built for it.





In preparing Army Ballistic Missile Agency tower (left) for heavy thrust of Saturn booster, steel pilings as long as 60 ft. were driven into bedrock to provide support for an enlarged blast deflector pit, new steel structural beefing and two 101-ft. steel girders which help support a crane hoist atop the concrete tower. Jupiter is being tested on left side of tower; Saturn will be tested on right side. Saturn test complex is getting new fueling facilities and a raised observation bunker with earthen barricade to provide line-of-sight view of test.

Idlewild 707 Mishap Sets Off Probes

CAB will try to learn why landing gear arm snapped on takeoff, and how airport mobs can be stopped.

By Glenn Garrison

New York—Successful emergency landing at New York International Airport last week of a Pan American World Airways Boeing 707-120 jet transport while a wild mob scene took place at the airport has led to a two-pronged investigation of the incident.

Civil Aeronautics Board will attempt to find out why the jet's left main landing gear truck beam snapped during takeoff, causing the loss of two of the airplane's eight main wheels, and also what can be done to prevent a recurrence of the uncontrolled swarming of thrill-seekers onto the airport, choking the movement of emergency vehicles and endangering themselves and the entire emergency operation. The CAB hearing is scheduled to begin July 30 in New York.

The serious danger raised by the milling spectators has caused concern to other segments of the industry. Federal Aviation Agency Deputy Administrator James T. Pyle said his agency was looking into the situation to determine exactly what the situation at Idlewild was. Pyle said that if the problem was as severe as it appeared, it must be corrected at once because it might occur again and at other airports. It should be possible, Pyle told AVIATION WEEK, for FAA and airport operators to work out procedures to handle both fire fighting and policing of crowds, but first the areas of responsibility must be established. FAA, Pyle said, was to file a report on the Idlewild situation late last week.

Routing of aircraft in such emergency situations to military airports rather than civil fields was proposed last week by the master executive council of Pan American's Air Line Pilots Assn. unit, and forwarded to CAB as a resolution. Pan American pilots cited "complete breakdown of the airport security and ground control safety procedures" and said the death toll could have run into the thousands if the jet had veered off the runway.

The plane, with 102 passengers and 11 crew members aboard, took off on a routine flight plan, Idlewild to London nonstop, at 8:37 p.m. July 11 and was almost immediately notified by the tower that the two wheels had dropped off. This was estimated to have occurred at 25 to 50 ft. of altitude. Capt. Edward Sommers landed the plane at 12:29 a.m. with wheels down in a 10-kt., 90-deg. crosswind, which helped him keep the left wing high. He touched down approximately 1,000 ft. from the end of the 11,200-ft. Runway 13R and stopped his roll about 6,000 ft. from the end. He used the right brake and all four thrust reversers instead of the normal two. Port of New York Authority firefighters had laid 3,000 ft. of foam at the other end of the runway but the plane stopped considerably short of the foam. The broken beam and the bottom of the strut plowed along the runway and set off a continuous stream of sparks. About 10 in. of the strut were ground off until the strut was even with the cross bolt that holds the truck beam.

There was no fire, and the only injuries—reportedly minor—occurred to three among about 25 passengers who used the emergency chute to deplane until a loading ramp could be taken through the crowd to the plane.

Sommers circled, burning off fuel, for almost four hours in the vicinity of Idlewild and to the southeast, at 2,000 to 3,000 ft. altitude. The jet grossed 244,805 lb. at takeoff and weighed about 155,000 lb. when it landed with a meager 10,000 lb. of fuel remaining.

The pilot did not jettison any fuel. The dump chute pipes are not retractable, and he was afraid the pipes would drag the runway if the gear strut dug in, creating another source of sparks and a danger to onlookers in case the pipes broke off.

CROWD lining Idlewild Runway 13R was estimated at 4,000 people. Mob was kept about 500 ft. off runway until 707 landed but then spectators surged around.

Main Landing Gear

Main landing gear of the Boeing 707 consists of four wheels each, mounted below an oleo strut utilizing a 22-in. stroke. Wheels, mounted in pairs in front of and behind the main oleo, are described by Boeing as a "walking gear." Each set of four wheels is referred to as a truck and connects to the main oleo on an arm hinged at the oleo thereby allowing the truck to walk over a bump. Oleo and the connected arm form an inverted "T."

In a normal takeoff, the front pair of wheels usually leaves the runway first. If the break in the attaching arm occurred after considerable airspeed was gained, sufficient weight would not have been borne by the gear to allow the bottom of the oleo strut to contact the runway, even though the rear wheels of the truck were still on the ground. On landing, the rear wheels of the truck usually contact the ground before the front, thereby reducing the landing impact by spreading it over a longer time period.

The part that failed is a hollow forged

steel beam of 7-in. diameter. It connects the axles of the tandem two pairs of wheels in each main gear. Boeing subcontracts the part from Cleveland Pneumatic. Two incidents involving the part have taken place with the KC-135 military tanker, counterpart of the 707. On both occasions the beam snapped while the gear was being jacked up, and Boeing says this was because of faulty placement of the jack, putting undue tension on the beam.

Boeing points out that KC-135s have logged more than 100,000 hr. without encountering any failure of the part except as noted above. The KC-135 part is almost identical to the 707 part, but is somewhat more rugged because of the higher gross weight of the military jet—some 300,000 lb. as against 248,000 lb.

Pending the outcome of the investigation, Pan American, after a general fleetwide inspection of the beams, will inspect them during the 60 hr. terminal service instead of at the 225 hr. equalized maintenance point. The airline says this is a purely precautionary measure. Trans World Airlines also inspected its whole jet fleet, found nothing out of the ordinary as far as the part is concerned but will perform an inspection on a daily basis instead of at 200 hr. American Airlines also will inspect at each trip instead of at a periodic check.

The airplane that lost its wheels was back in service last week. Time on the plane was 2,021 hr., least of any of Pan American's jets. Highest time on any of them as of last week was 2,361 hr.

During the emergency Idlewild was a scene of mounting chaos and confusion as an estimated 50,000 spectators, alerted by radio and television bulletins to the possible tragedy, poured into the airport and snarled traffic for miles.

By about 10 p.m. efforts were made to screen traffic into the field but the situation was completely out of hand. People abandoned their cars on the parkway, climbed fences, converged on the field even by boat and in skin diving gear.

Regional Federal Aviation Agency Director Joseph Blatt called the crowd's behavior a "disgraceful performance" and described its effect on FAA efforts to handle normal traffic during the emergency. People milling over the field made it necessary to shut one of the two active runways and use only one for landings and takeoffs. From 11 p.m. until 11:45 there were delays as controllers got further reports of people on the runways. By 11:45, Blatt told AVIATION WEEK, the situation was hopeless and the field was shut down to all traffic. A further complication was erratic communication between FAA and ground equipment on the field, Blatt said. During the last 15 min. before the jet landed, Blatt said, communication between him and Airport Manager Vincent Carson was cut off because Carson's car radio was performing erratically. At this time the pilot was running low on fuel, and when he was turning on base leg he couldn't get information as to whether the runway was cleared of vehicles or not because of this communications lag, Blatt said. It was not until 2 a.m that FAA was sufficiently certain that the field was clear to reopen the runways.

AFTER two wheels of Pan American Boeing 707 dropped off at takeoff from Idlewild, the jet made a wheels-down landing. Broken landing gear beam and bottom of strut plowed along runway. Strut was ground off until even with cross bolt holding truck beam.

During the invasion of the airport from all sides, the FAA's airport surface detection radar was picking up the unfamiliar shapes of a number of pleasure boats approaching the field from Jamaica Bay.

Port Authority Executive Director Austin Tobin and New York City Fire Commissioner Edward Cavanagh publicly exchanged insults after Cavanagh touched off a jurisdictional dispute and accused the Port agency of poor cooperation with the city in handling the emergency. The two agencies are now working out a new procedural plan for future fire and rescue cooperation.

PanAm was satisfied with the Port Authority's handling of the rescue preparations if not with the crowd situation, which Sommers called a "menace" and one of his chief worries during preparations for the emergency landing.

Tobin later told reporters that the Port Authority would not be able to handle a similar situation if it happened at Idlewild or the other New York airports. He suggested that the answer was for news media to avoid the type of coverage that would stimulate the flow of curiosity-seekers to the airport. The Port Authority brought in all the extra police personnel in its own employ that it could, with a peak total of 150 Port Authority police on duty during the emergency. Of these men, about 30 were involved in the actual rescue operation and not available to handle the crowd problem.

The crowd lining Runway 13R, estimated at 4,000 people, was kept about 500 ft. off the runway until the plane landed but then went out of control, surged forward and surrounded the airplane. The Port Authority considered that a dangerous situation continued to exist because of the possible explosion of the aircraft tires, which it said could occur any time until they cooled off in 30 to 45 min. Efforts by Port Authority and city police to get the crowd out of the way were only intermittently successful and finally, after repeated warnings, the crowd was sprayed with foam. Several reporters and radio and TV personnel were caught by the Foamite hoses, and later raised a formal protest. They insisted that the dousing was deliberate—one compared the incident to the Japanese attack on Pearl Harbor—but the Port Authority denied this emphatically and said its men were only trying to handle a dangerous situation and couldn't isolate the newsmen from the rest of the crowd.

It had been reported that the jet might attempt a belly landing, which would have been the first for the jet transport. According to Boeing, no KC-135 has made a belly landing either, but the aircraft would take such a landing as well or better than a piston airliner. The reasons, Boeing said, were the heavy keel beam down the 707's belly, the heavy gage metal of the wings, the sweep-back of the wings. The airplane's engine pods are designed to break off before the wing nears structural failure. Boeing B-47 jet bombers have made belly landings, encountering no unusual problems, Boeing said.

CAB Examiner Urges Return Rate Favored by Local Service Airlines

Washington—Local service carriers won an initial victory last week in their demands for at least a 12% return on investment, but they remain united in their opposition to the complex formula used in determining the rate favored by Civil Aeronautics Board Examiner William J. Madden (AW May 12, 1958 p. 40).

In his initial decision in the Rate of Return Local Service Carriers Case, Madden rejected an earlier recommendation for a 9.5% rate suggested by Bureau Counsel for the CAB, but he upheld the Bureau's use of a cost-of-capital approach as opposed to airline desires for some form of operating margin rate (AW June 9, 1958, p. 32).

Specifically, the examiner found that the rate used to fix the profit element for local service carriers has been insufficient to aid the carriers in attracting new capital or to provide reasonable compensation for the investors, and he recommended:

- **Rate of return** of 12.5% for closed rate periods, and 8.5% for open periods.
- **Plane mile floor** of 3 cents per plane mile in special cases where a carrier's total investment may be less than 25 cents per route mile.

Emphasizing that the carriers have been unable to maintain their financial integrity because of low earning powers, Madden said that even the availability of subsidy has failed to improve marketability of their securities. "More realistic and practical-minded bankers," he said, view the heavy government regulation but see no assurance that laws providing for subsidy may not be changed "a year from today."

Although the Guaranteed Loan Act appears to have aided the airlines in their search for debt equity, the $5 million ceiling per carrier also constitutes a "limiting factor," the examiner said. As examples, he pointed to Bonanza Air Lines and Piedmont Airlines, both of which have practically reached their loan ceilings with the purchase of only six and eight Fairchild F-27s. In cases where the guarantee is not used, lending institutions are requiring a higher proportion of equity capital and often insist that the equity exceed the debt. Madden pointed out that in most of the Board orders authorizing loan guarantees, CAB has been "most emphatic" in urging the airlines to lower their debt ratios.

Madden disagreed with local service demands for a rate tailored to any type of operating factor on grounds that, while the rate is intended to cover all expenses, plus attracting new capital, it "is not intended to be the new capital." Use of operating factors for rate making, he said, tends to relate the return to the risk involved, instead of counting the risk as one phase in the over-all appraisal of what a proper return should be. The carriers made no attempt to determine a proper rate of return, and were "apparently stopped either by the magnitude of the undertaking or a conviction that the results would be unreliable," he said.

While agreeing that many airline objections to a cost of capital study presented by Bureau Counsel were well founded, the examiner said that adjustments to compensate for the "frailties called to attention" produced figures reasonable to arrive at a rate of return on investment. He noted that interest rate for future debts had been raised to 5.39% as a result of studies of actual figures contained in Guaranteed Loan approvals.

Answering airline objections that too little is known of local service stock transactions to apply the cost-of-capital approach study proper for trunklines, Madden noted that while the earnings-price ratios of the medium eight trunks "leave something to be desired from the standpoint of consistency," they reflect data most comparable to the smaller airlines.

Pointing to recent $1 million stock issue by Bonanza Air Lines at a cost of 17.88%, Madden also questioned why Bureau Counsel had allowed only 8% for such costs to service carriers and found they should be granted an allowance for such costs of 15% of the capital costs.

Disagreement between the carriers and the Bureau over a 55% debt-45% equity ratio used to obtain a final 9.5% rate was also rejected by the examiner who pointed out that present plans of the airlines will produce an over-all debt ratio of nearly 75%. "Consequently," said Madden, "rather than being disastrous, the carrier will enjoy a windfall if a capital cost computed with debt at 55% is applied to a capital structure which is actually 75% debt."

However, the examiner tempered his conclusions by indicating that while future financing plans of many carriers do anticipate higher debt, and Piedmont Airlines acquired a Guaranteed Loan which left the carrier with a 78/22 debt-equity standing, the CAB has issued warnings to all applicants that such approvals will not be continued. Disregarding the inordinately high ratios to which some carriers are tending and "assuming that by some means the Board's warnings will be converted to actualities," Madden said that actual ratios will fall within the 55 to 45 ratio.

Backing his recommendation for an 8.5% return for open rate periods, the examiner said that the airlines have failed to show any material risks during open rate periods which are not compensated for by a retroactive mail rate. Elimination of the open rate period is the "desirable goal," said Madden, and should therefore have a reasonable differential rate from the closed period to attain this goal.

Noting that the plane mile rate of 3 cents is inconsistent with the rate of return concept, the examiner said it is needed in special cases where carrier investment bases are unusually low and would apply to only 5 of the 13 local service airlines. In the past, this rate has been 2 cents but should be raised in proportion to the increased rate of return of 9.5% recommended by the Bureau. Madden added that he considers these special cases as temporary since such actions as the Guaranteed Loan provisions and retention of capital gains in re-equipment programs will enable these carriers to acquire new equipment and increase their investment bases.

Trunklines Emphasize Need for Rate Rise

Washington—Final briefs filed by domestic trunklines in the General Passenger Fare Investigation are re-emphasizing the carriers' needs for greater revenues and their general disappointment with a 12% fare boost recommended by Civil Aeronautics Board Examiner Ralph Wiser.

With few exceptions, the airlines have repeated their original pleas of three years ago, asking fare increases ranging from a low of 12.5% to a high of 20%. Recommendations of a 10.25% rate of return for the Big Four and 11.25% for the remaining airlines, and Wiser's suggested changes in depreciation policies, have met with the same objections filed by the carriers recently in exceptions to the examiner's decision (AW June 15 p. 41).

Again repeating its objection to the examiner's findings, the Air Transport Assn. urged the Board to "recognize that the airlines have a continuing need for capital; a higher level of earnings is needed to attract capital; and the industry's unique role among utilities requires a regulatory federal approach which fits the jet age industry."

While terming the examiner's decision as "initially sound," ATA said it was also "unduly restrictive" with respect to earnings elements and the ultimate fare adjustment needed.

Initial Court Ruling Upholds ALPA Officials in Strike Levy Dispute

Washington—Air Line Pilots Assn. top officials have won a round in preliminary court action on charges leveled by a dissident group of ALPA members that the pilots' union illegally imposed $1.1 million in membership assessments to aid pilots idled last year as a result of machinists and engineers' strikes at Capital Airlines and Eastern Air Lines.

Filed last March by pilots James R. Eads of Trans World Airlines and Lawrence Shapiro of United Airlines (AW Mar. 9, p. 328) in the U. S. District Court for the Northern Division of Illinois against ALPA President Clarence Sayen and treasurer Don J. Smith, the case was remitted to a special master in chancery, Augustine J. Bowe, who recently recommended vacation of a preliminary injunction previously granted and dismissal of the complaint.

Judge Philip L. Sullivan, prior to a final decree, has ordered that ALPA inform members who have not yet paid the assessments to do so by Aug. 6, without prejudice to any member, and also has raised a $1,000 bond deposited to secure the temporary injunction of Mar. 20, to $20,000 payable by last July 6.

Attorneys for the complaining pilots, said to represent nearly 11,000 of the 17,000 ALPA membership, say the increased bond has not been paid and that they will argue their case before Judge Sullivan, based on objections to the Bowe report. Major points made in the 40-page chancery report are:

- **Eastern and Capital** assessments were legal under the powers of ALPA's board of directors and neither Sayen nor Smith were guilty of fraud, bad faith or breach of duty.
- **Complainants are not** entitled to seek court relief because they have failed to exhaust "at least six" remedies provided under the ALPA constitution and by-laws. Legal action would be more proper after such remedies had been utilized, said Bowe.
- **Relatively small number** of ALPA members refused to pay one or both assessments. Before April, 95% of the assessments for Capital pilots had been paid and 82% had been paid to Eastern pilots.
- **Neither Sayen nor Smith** have authority to waive payment of assessments levied under authority of the board of directors and any decree ordering such action would be invalid since ALPA, as an organization, is not a party to the proceeding. Bowe termed ALPA an "indispensable" party defendant and noted that since the union had not been named so in the case, relief sought by the complaining pilots could not be granted.

In a 17-page objection to the Bowe report, attorneys for the dissenting pilot group contend that the six remedies mentioned were either incorrectly interpreted by the Master in Chancery or were too impractical to implement because of the wide scattering of individual union members.

'Unemployment' Benefits

They further contend that the Capital and Eastern assessments were for "unemployment" benefits beyond the authority of ALPA and that Sayen failed to tell the ALPA board of directors that the crew complement issue, which earlier threatened a pilot strike at Eastern, had been settled by a Nov. 12 agreement. By this action the directors were misled into voting benefits for the Eastern pilots, the attorneys said. They added that Sayen and Smith, as principal officers invested with specified duties in the union, were properly named defendants since ALPA is an unincorporated association which, under the laws of the state of Illinois, may not sue or be sued.

CAB Ends Hearing On Viscount Breakup

Washington—Midair disintegration of a Capital Airlines Viscount on May 12 near Baltimore, Md., may have been caused by the aircraft entering extremely turbulent air currents at a high rate of speed.

Three days of hearings by the Civil Aeronautics Board on the accident, which took the lives of 31 persons, have established only that the plane was not destroyed by either fire or lightning, as earlier suspected.

Ground witness testimony placed the aircraft at an average of 6,000 ft. altitude at the time of the accident, but subsequent testimony on the plane's nonstop flight from New York to Atlanta, Ga., and communications between the aircraft and Washington Air Route Traffic Control, failed to explain how or why the aircraft left an assigned altitude of 14,000 ft. and descended to the altitude of the breakup. The Capital flight had requested a change of course and reported dropping airspeed to 170 kt. because of severe thunderstorms.

Answer to the accident apparently lies in a four minute gap existing between the time of the aircraft's last report to Washington ARTC and its actual disintegration, as reported by witnesses.

Flight crew of a Northeast Airlines Viscount, which followed the Capital plane at a 16,000 ft. altitude by one minute, told the Board that the Capital plane had requested permission to leave a southwesterly course and skirt a threatening weather front in the area north of Baltimore because of an inoperative airborne weather radar. The Northeast plane reduced speed to 155 kt. and continued its course near the front, but the copilot reported hearing what he believed to be several attempts by the Capital aircraft to again contact Washington ARTC. The Washington center, in turn, failed in several tries to regain contact with the Capital turboprop plane.

At about the same time, the hearing panel was told a U. S. Navy pilot, flying a twin engine Beechcraft at 2,500 ft., failed to break through two converging weather fronts in the crash area, made a 180 deg. turn and while completing it saw debris from the Viscount raining from overhead clouds.

A private commercial pilot in a DC-3 also told the CAB panel that he intentionally skirted the entire area because his weather radar displayed some of the "brightest" storm cells he had ever seen.

Although the Capital flight had received no reports of excessive turbulence in the area from its company, U. S. Weather Bureau officials later testified that extreme downdrafts and wind currents could well exist far forward of an approaching storm front.

Structural investigation report of the wreckage by a CAB team indicated that the horizontal stabilizer of the plane broke first, followed by the right wing and sections of the fuselage. In all instances, the direction of the breakage was upward and back, indicating failure due to excessive pressure from above, as would be experienced in a prolonged dive.

Officials of Vickers-Armstrongs Aircraft, builder of the British plane, have also testified that the aircraft met rigid tests that would assure such damage could not take place in level flight, but added this could have happened under an "unusual occurrence."

Technically, the investigation remains open, and the only findings arrived at by the CAB panel is that the Capital plane was not torn apart by either fire or lightning, a point which medical testimony indicated as true.

However, the Board's Safety Analysis Division is sifting information in light of a past beefing-up of the Viscount's horizontal stabilizer four feet from the tail cone on each side. Breakup of the stabilizers occurred at the exact point where the structural covering skin of the aircraft had been strengthened, it was testified.

ACC Urges Government to Support Surplus Aircraft Export Efforts

By Robert H. Cook

Washington—Air Coordinating Committee members have emphasized a need for greater legislative and financial support from the government as a means of aiding surplus aircraft disposal in foreign markets.

Reviewing the problem faced by U.S. air carriers in disposing of 843 twin and four engine piston aircraft by 1961, ACC recommended that private enterprise set the practical pattern for aircraft sales, but tempered its study of the disposal problem with observations that 600 foreign airline planes and 250 U.S. military aircraft will also enter the world-wide surplus plane market by 1961.

Major recommendations made by the committee are:

- **Government should adopt,** and make public, a policy statement setting forth the relationship between the surplus problem and development of manufacturing and air transport industries both in this country and abroad.
- **Government financing agencies** should determine what may be done to improve the availability and terms of financing for the export of surplus piston transports, in line with the government policy statement.
- **An existing government** agency should serve as a liaison information center between private industry and government agencies to satisfy the needs of both in sales and financing problems.
- **Release of surplus military** aircraft should be closely regulated to prevent a possible depressing of the market for used civil transport planes.
- **Scope of surplus problem** is so broad that studies should be continued to find other possible markets.

Overshadowing the size of the piston engine fleet to be disposed of is the aggregate book value of the 556 four engined and 287 twin engined aircraft, said the committee. Originally valued at $827 million, the fleet will have an aggregate book value of $254 million by 1961 with more than 77% of this total accounted for by Douglas DC-7 types, Lockheed L-1049H and L-1049G aircraft and Douglas DC-6B types. More than $123 million of this total reflects the book values of 129 DC-7 types scheduled for sale between 1958 and 1961, ACC said.

"Unfortunately," the committee said, "some of these large types are most competitive with jets and turboprops now going into operation on major foreign airlines who are themselves about to dispose of similar piston type aircraft."

Further complicating the situation is the apparent limited market for most of these planes on smaller foreign airlines and a wide discrepancy between book values and recent market prices, the committee said. Recent aircraft sales have brought as much as $956,000 for a DC-6B with a 1959 book value of only $403,000, while a Lockheed L-1049G, with a book value of $1.1 million sold for $1.9 million and a Convair 340/440 valued at only $193,000 brought $463,000, ACC pointed out.

Explaining its recommendations, the committee said government publication of a policy statement on used aircraft disposal would have a beneficial effect on aircraft dealers and brokers by assuring them the government recognizes their problem and is attempting to aid them. In addition, it would influence government financing agencies whose decisions will have an impact on the success of private efforts and also influence the attitudes of many foreign nations faced with a similar problem. Citing private enterprise as the "primary force" in selling used planes abroad, ACC emphasized, "It is essential that the government grant much the same treatment to the disposal abroad of used aircraft as it does of new aircraft."

Financing continues to be the largest problem in the sale of used planes abroad, and ACC urged that government lending agencies continue studies designed to help alleviate the problem, but noted the "limited effect" of government action in this area since the entire disposal problem is so extensive that sales abroad "will probably provide only a fraction of the total answer."

The committee also pointed out that the Export-Import Bank has indicated it would consider financing used aircraft on its terms. However, ACC said, the lending institution loans in dollars and collects in dollars, with the resultant disadvantage that there is presently a shortage of foreign exchange, including dollars, in many less developed foreign countries.

Surplus military aircraft should be disposed of in a manner to avoid unduly disturbing the commercial market since the over-all disposal problem "appears to be critical enough without this additional difficulty," said the committee. A policy decision should be made on this matter, balancing the amount of funds to be recovered by the government from these sales against the potential losses caused commercial users. ACC emphasized that it does not agree with either airlines or manufacturers favoring an absolute prohibition of such sales, but believes in an individual case approach, pursuant to governing procedures, should be adopted.

Under its suggestions for further study of the surplus plane problem, ACC recommended a maximum of free enterprise in foreign sales with government assistance by offering market studies by government agencies, banks and brokers, clearance of any existing regulations that may hinder the export of aircraft and encouragement of leasing arrangements by private companies, plus government lease-sale enterprises and aid in establishing adequate ground and maintenance facilities.

In the domestic field, the committee favors further investigation of present leasing agreements, trade-ins, turboprop modifications, non-military use of surplus planes by the government, salvage values and possibility of the creation of a mothball air fleet through appropriations to civil government agencies for use by commercial carriers in civil use under mobilization or war conditions.

Reviewing the entire problem, ACC noted that, in light of the Cherington Report, the primary objective of used aircraft disposal is to aid in the financing of new planes, so that "great weight" should be given to the market-vs.-book value figures.

"It should also be recognized," the committee pointed out, "that to finance new jets, sale of used aircraft abroad is only one means; government direct loans or loan guarantees, for example, are also possible."

DC-8 Price to Rise

Rising cost of production resulting from higher labor and material costs will cause price adjustments for DC-8 jet transports purchased after Aug. 15, says Douglas Aircraft Co. Present customers and prospective buyers were advised that the base price of five variations of the 150-passenger transport will be increased by amounts ranging to 10%.

Comet 4 Load Factor 92% Over Atlantic

London—British Overseas Airways Corp.'s de Havilland Comet 4 load factors are running at about 92% on the North Atlantic route and more than 70% on the London-Tokyo run, de Havilland reports.

Passenger break-even load factor on the Comet 4, after allowing for interest on capital and training and route-proving costs spread over the aircraft's life, is between 43 and 47%, according to route, seat arrangement and season.

Report on Japan Air Lines, Part II:

Japanese Line Plans Transition to DC-8s

By Irving Stone

(This is the second of two articles on Japan Air Lines. The first appeared in last week's issue of AVIATION WEEK.)

Tokyo—Readying itself for the new high-speed, greater capacity jet transport service it will usher in by next July, Japan Air Lines is channeling intensive effort to ensure smooth transition in a gradual changeover from piston-powered airplanes.

Preparational work began in August, 1958, when Japan Air Lines set up a special planning function to cope with the new approaches and work loads the jet transport will introduce. Originally established with two departments—one in Japan Air Lines, and the other in Japan Aircraft Maintenance Co. in which the airline owns stock—these activities were combined early this year under a single Japan Air Lines department—DC-8 Planning Office.

"Paper-jet" analyses are being made on central Pacific runs, later will be extended to include northern Pacific service. In these analyses, JAL is getting valuable coordination from USAF weather service in Japan.

Planning office has estimated that JAL's DC-8s will each fly at an average of 3,700 hr. per year, for 1960.

For 1961, Japan Air Lines expects that the average utilization rate will be about 4,000 flying hours per aircraft, or 16,000 hr. total for the four DC-8s.

This compares with about 3,300 flying hours per year per aircraft for the piston-powered aircraft JAL is using (DC-7C and DC-6B), indicating that DC-8s will chalk up about 700 flying hours more per year per aircraft than the piston-powered transports on the airline's routes.

The Japan Air Lines crew situation is projected to change as DC-8 operations begin. Now, in overseas (Pacific) operations and Tokyo-Singapore runs, the airline has 20 pilots and 32 copilots, who are Japanese. American pilots, totaling 29, are furnished by United Air Lines and Trans-Ocean Air Lines to JAL.

Japanese Civil Aeronautics Authority conducts an initial training operation for student pilots, who are later funneled into the airline's operation for final training. JAL's training school for new copilots in Tokyo now has 26 trainees going through.

Anticipating jet training requirements, Japan Air Lines already has sent its chief pilot (Capt. Ejima) to Douglas Aircraft to receive DC-8 flight training, using the simulator. Ejima will be the instructor for JAL's simulator training in Tokyo. It is estimated that each DC-7C captain will require 20 hr. of simulator training and about 9 hr. of actual flying training.

For the DC-8, the airline will train only Japanese pilots and copilots, flight engineers and navigators, but initially both American and Japanese first pilots may be used on DC-8 runs.

Training of first three JAL cockpit crews probably will be given on United Air Lines flight simulator (Link) because JAL's Link simulator will not be in operation until April, 1960, as a result of a delay in final engineering data released by Douglas, which required changes in calculated performance based on flight test results.

For the four DC-8s which Japan Air Lines will use, a minimum of 20 cockpit crews (80 people comprising pilots, copilots, flight engineers, and navigators) will be required. In addition, there will be 20 crews of flight attendants, comprising seven per crew—one chief steward, two assistant stewards, and four stewardesses.

As it now does in its transpacific DC-7C service, the airline will stress, in the DC-8 operations, the "material and devotion angles" to distinguish its service from that of other carriers. Japanese hostesses offer very high efficiency, outstanding courtesy. Hostess costumes —the traditional kimono, used during dinner-time service—offer a touch of color and atmosphere.

Japan Air Lines requires that its stewardesses be high school graduates. Age limit is 25, and they must be unmarried. Enough English must be spoken to conduct reasonable conversation.

To meet future competition from other international carriers, JAL management feels that it will be required to operate with increased capital and equipment. One example prompting this approach is that in Europe a plan is under way to create an arrangement between the various carriers to enable them to operate on a unified basis to effect greater economies.

To maintain its place in the competitive field, therefore, Japan Air Lines planners feel it should realize, as soon as possible, its round-the-world service position, and that its capital should increase about three to five times that of its present capitalization which is almost 10 billion yen ($28,000,000).

Eighty per cent of JAL's stock is now owned by the Japanese government, 20% by commercial holdings. When the airline establishes its round-the-world service, government stockholdings in Japan Air Lines should decrease to 50%, JAL management feels, with the 30% difference converted into commercial holdings.

The airline will participate in a world-pool arrangement now being negotiated between all DC-8 operators (except United Air Lines). Agreement is expected to be reached early this month in Stockholm, Sweden, where Scandinavian Airlines System is chairman of the meeting. This pool arrangement will permit members to draw spares from "provider airlines" at various world stations. JAL will be the "provider" in Tokyo.

The pool arrangement covers spares which are common to the various carriers. Categories for parts include class AA, consisting of 148 items costing $225,000, with New York International Airport as the only Class AA station; Class A, covering 147 items costing $154,000, with Tokyo's Haneda Airport included in this class category; Class B covering 80 items costing $94,000; and Class C covering 24 items costing $15,000.

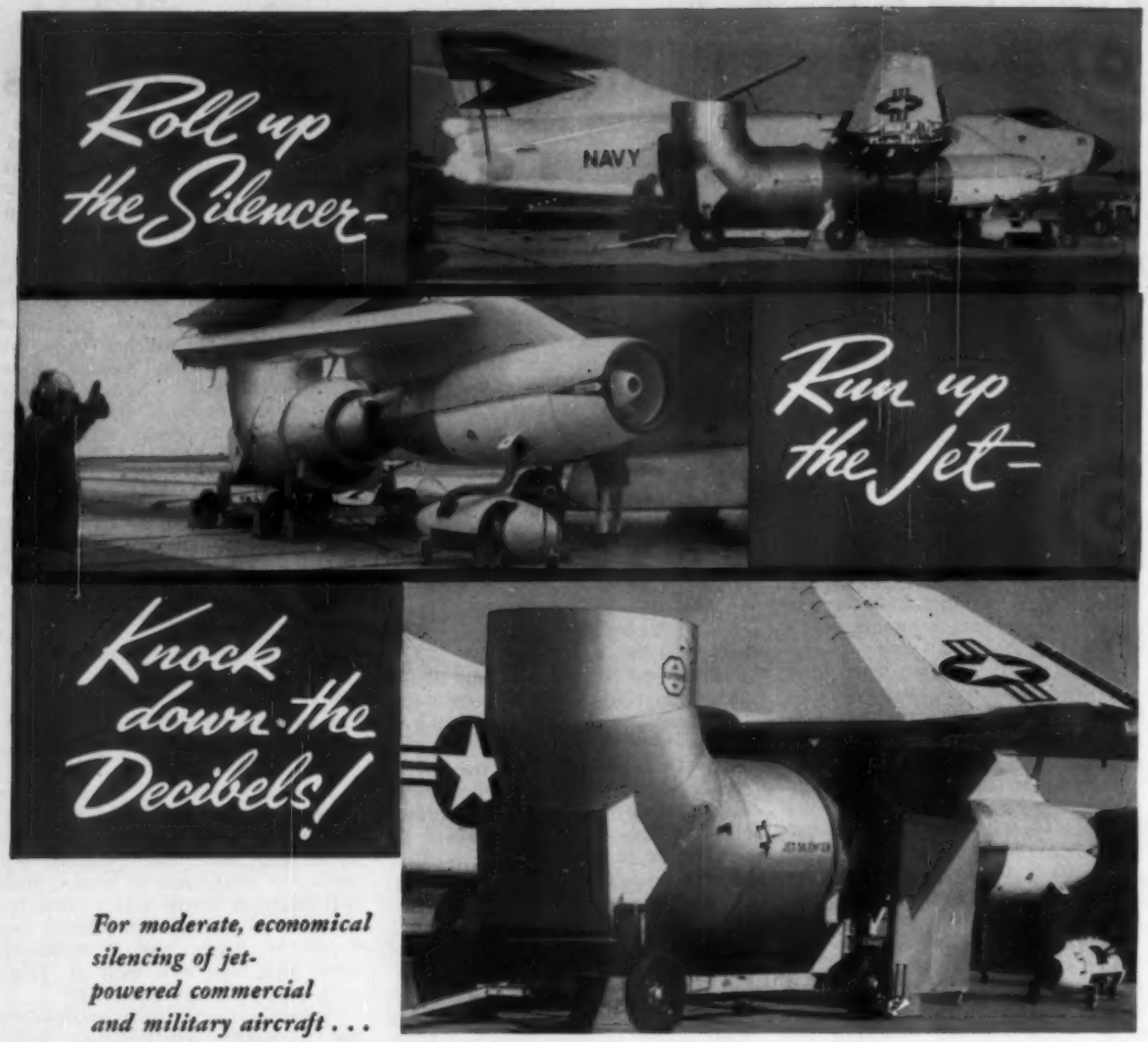
For powerplants, Los Angeles International Airport will stock two engines each at "provider airlines" United Air Lines and SAS. San Francisco will stock one powerplant at United, there will be one at Seattle with United, two each at Honolulu with United and Japan Air Lines, one at Anchorage with SAS, and two each at Tokyo with Japan Airlines and KLM.

Powerplant and parts arrangement for Los Angeles, San Francisco, Seattle and Honolulu will be the exception for JAL and United to the participation arrangement in the world scheme.

There also is a pooling arrangement for ground equipment between Pacific carriers using Douglas DC-8s, Boeing 707s and Convair 880s. These carriers include Japan Air Lines, Pan American, Northwest, KLM, SAS, Swissair, Qantas, Air France, Air India International, and, later, Philippine Airlines. BOAC also may join.

There are separate negotiations going on now between European and U.S. operators for ground equipment pooling.

Japan Air Line's maintenance and overhaul work is performed for it by Japan Aircraft Maintenance Co. (JAMCO). Created in 1952, one year after Japan Air Lines was formed, JAMCO came into existence as a matter of necessity. The airline didn't have adequate maintenance skill as a result of the post-war gap, hence, it combined with Northwest Airlines and Trans-



For moderate, economical silencing of jet-powered commercial and military aircraft . . .

NEW KOPPERS PORTABLE RUN-UP SILENCER TAKES THE PUNCH OUT OF JET NOISE

Now, airports, air bases and manufacturers of jet engines or airframes can run up jet engines without complaint or creating physical hazards. The Koppers Portable Run-Up Silencer reduces noise by 25 to 30 decibels—lessens the risk of hearing damage to operating personnel, improves community relations and reduces speech interference.

The new portable silencer inhibits the generation of jet engine noise, rather than suppressing it after the noise has reached full intensity. The unit is light in weight and completely portable—no direct attachment to the aircraft or engine is necessary. Look to Koppers with its longest experience in the industry to solve your aviation noise control problems.

Write for Koppers new sound control brochure today. KOPPERS COMPANY, INC., Sound Control Department, 3503 Scott Street, Baltimore 3, Maryland.

Official United States Navy Photographs

KOPPERS

SOUND CONTROL

Engineered Products Sold with *Service*

Ocean Airlines to establish JAMCO in order to get the benefit of Northwest and Trans-Ocean maintenance skills and capital assistance. This joint maintenance program has operated very smoothly since its inception.

Japan Air Lines owns 60% of JAMCO, the other 40% being vested in Northwest, Trans-Ocean and other commercial interests.

According to the present workload, JAMCO performs about 80% of its services for Japan Air Lines, approximately 20% for other carriers, including Trans-Ocean, SAS, and KLM.

DC-8 Overhaul Base

Main overhaul and maintenance base for DC-8s will be at JAMCO in Tokyo. Overhaul of special components, such as constant speed drives, turbo-compressors for cabin air, and some gyro components will be done in the United States, probably by United Air Lines at San Francisco.

For the first two years of DC-8 operation, the Pratt & Whitney JT4A-3 engines probably will be overhauled both in Tokyo and the U. S. (probably by United in San Francisco).

Thus, beginning September, 1960, and ending in March, 1961, one-third of the engine overhaul probably will be handled in Tokyo, and two-thirds in the United States. From March, 1961, to March, 1962, the ratio will be reversed, and beginning in April, 1962, JAMCO will take over all of the overhaul work which JAL previously will have farmed out in the United States.

JAL now is proposing to Japanese Civil Aviation Bureau that it be allowed to perform maintenance and overhaul of DC-8s in accordance with U. S. procedure and time periods (ATA system).

Spares requirement for JAL's four DC-8s for 1960 and 1961 in the non-expendable category are estimated to include:

- **Airframe components,** costing $6,569,000. Category includes items such as landing gear, control tabs, pressurization equipment, brake assemblies, etc.
- **Engine parts,** $874,000.
- **Radio, electrical** and instrumentation, $1,514,000.

Expendable-spare category includes:

- **Airframe hardware,** $444,000.
- **Engine parts,** $1,122,000.
- **Radio, electrical** and instrumentation, $326,000.

Total outlay will be $5,852,000, in accordance with this projection, Japan Air Lines declares. These figures are high in comparison with U. S. carrier spare expenditures, JAL says, because of the stock necessary as the result of the great distance between the Haneda maintenance shops and Douglas and other manufacturers.

For the en route line-maintenance requirements, the spares will be ordered soon. For other requirements, such as parts needed for overhaul, these will be determined after study, keeping in mind the possible effects of any pooling arrangements for maintenance with other airlines.

For overhaul done by JAL alone (normal procedure, if pooling is not entered into), spares will be ordered in time to meet overhaul schedules. It is expected that airframe component spares for overhaul will be required approximately eight months after the DC-8 goes into service, and in about three month for engine spares.

Inauguration of complete operational status of JAL's four jets will place its piston-powered DC-7Cs and DC-6B in reserve status. These possibilities exist: Sale of the piston-powered planes or, in the event this is not feasible, the airline may use them in domestic service, such as between Tokyo and Fukuoka. Also, the piston-powered planes may fit in with the airline's plans for an all-cargo transpacific service. Since May, Japan Air Lines has been operating Trans-Ocean Air Lines' DC-4s under charter contract one flight per week between Tokyo and San Francisco. This operating experience will indicate the degree of cargo-service expansion which is feasible when the jets come into the passenger field.

Re-Engining Planned

Beginning in the fall of 1960, Japan Air Lines probably will install Pratt & Whitney JT4A-11 engines with 17,500 lb. thrust dry, to replace the JT4A-3 engines (15,800 lb. thrust dry) it will have on the DC-8s as they are delivered. The new engines will be substituted at overhaul periods. Substitution of the new engine is expected to cut the payload limitations for operation out of Haneda Airport until a new, longer runway is completed.

Now under construction, this runway will be 10,500 ft. long and will extend adjacent to the existing 8,400-ft. runway, which also will be extended to about 10,000 ft.

The new runway construction is expected to be completed in November, 1963, while extension of the existing runway will be completed in December, 1964.

Meanwhile, the existing 8,400-ft. runway will have its overruns paved to give an additional 500 ft., for a total of 8,900 ft. This will limit JAL's DC-8 operation to about two-thirds payload for the Tokyo-to-Honolulu run in the summer. It also will necessitate an intermediate stop at Anchorage, Alaska, on the Tokyo-Seattle run. However, for operations into Haneda, the 8,900-ft. runway will be sufficient.

For the period April, 1958, to March, 1959, Japan Air Lines' operations showed 226,159,555 passenger miles for international service, and 180,336,323 passenger miles for domestic (Japan) service.

In international service, transpacific operations carry the heaviest traffic. Other international routes in addition to transpacific include: Tokyo-Okinawa-Hong Kong (two flights weekly), Tokyo-Hong Kong-Bangkok-Singapore (three flights weekly), and Fukuoka-Okinawa (two flights weekly).

The Tokyo-Taipei-Hong Kong run is planned to commence on Aug. 1, with two flights per week. When this service begins, the Tokyo-Hong Kong portion will be served by daily flights.

On a non-schedule basis (perhaps every three months, or longer if not enough traffic is ensured), Japan Air Lines operates the Tokyo-Los Angeles-Sao Paulo (Brazil) run via New Orleans-Caracas, Belem-Rio de Janeiro, using a DC-6B. JAL unloads only at these intermediate points, beginning with Los Angeles, because it has no traffic rights to pick up passengers at Los Angeles and beyond for this run.

Eastern Exonerated On Oversale Charge

Washington—Eastern Air Lines has been exonerated of charges brought by Civil Aeronautics Board compliance attorneys that the carrier had intentionally engaged in unfair competition by overbooking its flights.

Recommending dismissal of the charges in the Eastern Air Lines, Inc., enforcement proceeding, CAB Examiner William F. Cusick found that overbookings cited by compliance agents during a one-month period in 1957 resulted largely from human error and caused a minimum of actual oversales. A study by compliance agents from Feb. 4 to Mar. 14, 1957, alleged that Eastern overbooked 41 of its 6,840 flights, with an average of 1.1% flights per day overbooked.

Eastern submitted an analysis of flights from Jan. 16 through April 13, 1958, since records for the 1957 period had been disposed of as permitted by CAB Economic Regulations, prior to the time compliance attorneys served the airline with a bill of particulars. Eastern's study of 15,640 flights showed a total of 44 overbooked, with an average daily number of flights overbooked of only 0.5%, the examiner noted.

Pointing out that overbookings usually stemmed from sales made through postings or crossed postings, misfiling, sales by another carrier, time lags in communications or errors in teletype messages, Cusick said, "while errors are not to be condoned, the Board obviously cannot regulate out of existence all human or mechanical mistakes."

AEROFLOT MAINTAINS an almost constant lineup of 12 departing jet transports in a double row in front of its maia terminal at Moscow's Vnukovo Airport. Shown above is the left-hand row with a mixed bag of 70-passenger Tu-104As and 100-passenger Tu-104Bs being serviced prior to departure.

Aeroflot Improving Sales Techniques

Pressures of international competition, expanding jet fleet force promotion, passenger service changes.

By Robert Hotz

Moscow—Aeroflot is using its rapidly expanding fleet of gas turbine powered transports (AW July 6, p. 34) to develop air travel as the primary method of passenger transportation within the USSR and to provide a fast and politically secure communications network between Moscow and the major capitals of Europe, Asia and America.

Both of Aeroflot's objectives under the current Seven Year Plan that began last January have top level political backing and a much higher priority than ever before on the design and production facilities of the Soviet aircraft production ministry.

Domestic expansion of Aeroflot's jet fleet is supported by a government policy decision that air travel is to become the primary method of passenger transport, with the rail lines and river boat network devoted primarily to cargo. But Aeroflot's cargo capacity is also scheduled for an enormous increase under the Seven Year Plan, primarily for areas where rail and river transport don't exist. Using Aeroflot's 1956 cargo tonnage as an index of 100 (Aeroflot is reluctant to release absolute cargo statistics) the airline has been given the task of raising its cargo capacity to more than six times this figure by 1965, with claims that a 19% increase over 1956 tonnage was reached in 1957 and a 46% increase over the 100 index took place in 1958.

Although Aeroflot is operated on a decentralized basis with seven domestic regions plus the international division, the highly centralized character of the Soviet government makes Moscow the hub of both its domestic and international operations and results in the concentration of a high percentage of Aeroflot's jet fleet at Vnukovo Airport, Moscow's airline terminal. Nearly half of the total Aeroflot jet fleet (we counted as high as up to 60 planes) can be spotted at Vnukovo almost any day, although other groups of Tu-104s, Il-18s and An-10As are based at regional centers such as Kiev, Tashkent, Tbilisi and Khabarovsk.

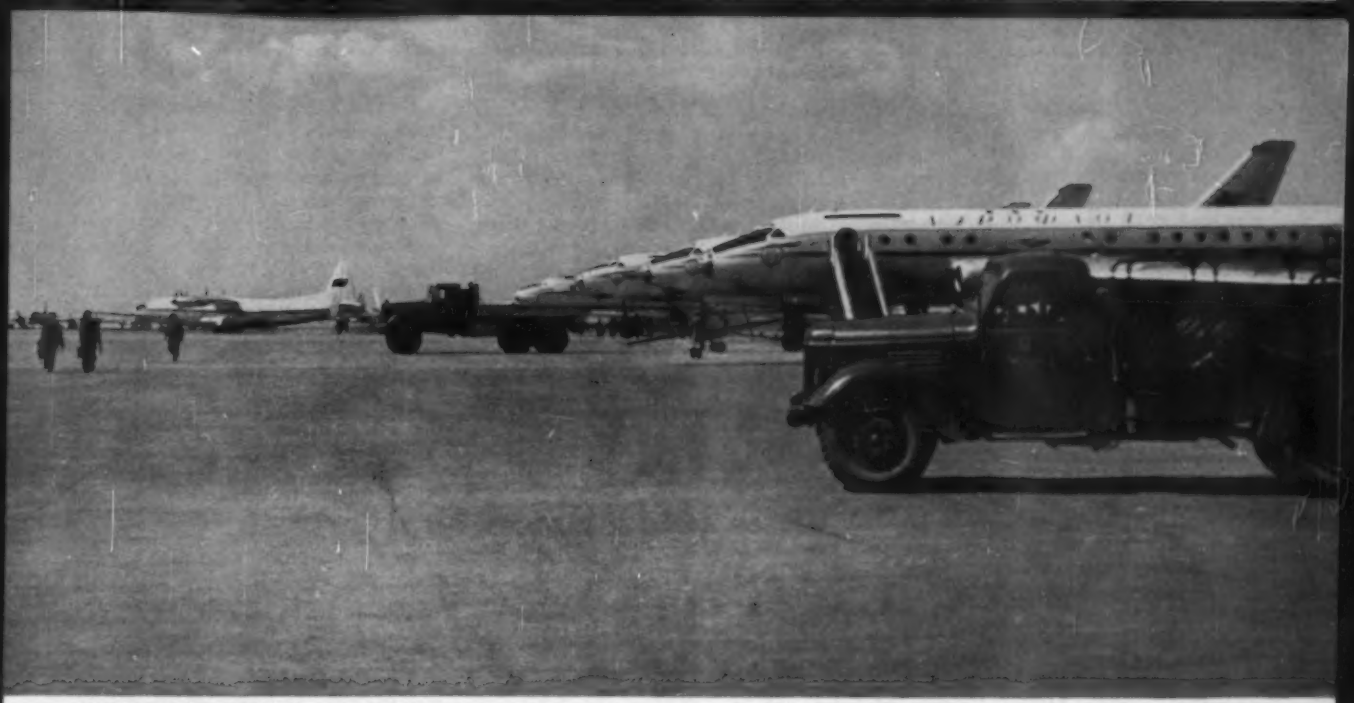
This concentration of jet transports at Vnukovo is deceptive to casual observers and gives rise to the oft-heard comment that Aeroflot's aircraft utilization rate is extremely low. More detailed observers of the Vnukovo scene, checking serial numbers and watching aircraft movements over most of the day, note that, although the total of jet transports on the field changes only slightly from day to day, they are not the same aircraft.

Aeroflot, with understandable pride, keeps a constant double row of six Tu-104 or Il-18 transports lined up in front of the main terminal building as a show piece for its primary jet arrival and departure area. Unless serial numbers are checked, this creates the illusion of a fixed fleet sitting for show purposes only. Actually in the case of the Tu-104B on the Leningrad run, the same aircraft may be in this show row several times a day and wind up in the evening in the same spot it occupied early in the morning. To some observers it would seem that this aircraft has been a museum piece, while actually it made two round trips to Leningrad and carried close to 400 people.

Maintenance Base

The Soviet airline also operates a sizable maintenance base at Vnukovo, accounting for an increment of planes parked on the far side of the field from the passenger terminal.

As an indication of the jet traffic volume at Vnukovo, by the end of June Aeroflot was operating about 100 daily schedules with its Tu-104 turbo-



RIGHT SIDE of the Vnukovo lineup shows four Tu-104As and an Antonov An-10A taxiing in the left background. Note the self-propelled loading stairs on the Tu-104A in the foreground, and the towbar attached to the nosewheel strut and the towing truck standing by. Truck in foreground has auxiliary power sources for starting turbojet engines.

jet fleet and about a dozen Il-18 daily schedules, with close to 90% originating or terminating at Vnukovo.

Aeroflot is still expanding its domestic jet services at a lively clip, with the bulk of the new services now coming with Il-18 service since this type equipment was extended during June from the Vnukovo hub to Tashkent, Baku, Simferopol and Mineralyne Vode. Tu-104B service is still expanding as this 100-passenger model went into service from Moscow to Sverdlosk and Krasnovodsk in addition to doubling its original Leningrad frequency.

Next big expansion of capacity will come with the shift of the An-10A from all-cargo service test runs to passenger service and the introduction of the Tu-114 into trans-Siberian service. Both are scheduled for initial Aeroflot passenger service this fall.

Aeroflot's rapidly growing seat capacity accruing from its jet fleet has presented it with a major sales and passenger service problem for the first time in its history and has produced major changes in these areas.

Traffic demand for Aeroflot service is still outstripping capacity, and like the U. S. Boeing 707 and British Comet jet transports, the Tu-104B is operating at close to 100% load factors. Jet flights in both Tu-104 and Il-18 equipment are booked solid for days in advance. Where only 24-passenger Il-14Ms are available, such as on the Kiev-Moscow run, they are sold out a week to 10 days in advance. International load factors are a more closely guarded competitive secret, but there are indications that Aeroflot is doing better on its competitive routes to Asia than it is in its European services.

Flying a total of 9 million passengers in 1958 out of a total population in the USSR of 208 million indicates the Soviet carrier still has a long way to go before it taps its full traffic potential.

Western observers flying Aeroflot's domestic services are usually surprised at the high load factors and the heavy traffic density, particularly in the more remote areas of Central Asia, Siberia and the Caucasus. This traffic seems to cut across the bulk of the population strata with no particular class or occupational group conspicuous for providing most of the passenger traffic. The main sources of Aeroflot traffic appear to be:

• **Official travel.** The highly centralized political and economic system of the USSR makes frequent travel to and from Moscow necessary for political and industrial officials at higher levels, usually accompanied by aides in proportion to their rank.

• **Military travel.** The far flung and multi-million-man armed forces of the USSR generate the same type of leave, change of station and official military travel that is a familiar segment of the U. S. domestic air travel scene.

• **International travel.** Bulk of the international traffic is political and business, with a rising seasonal ground swell of tourists during the summer months. Since the lowering of western European trade barriers with Red China, there has been a sharply rising traffic flow through Moscow to Peking as the shortest, fastest and cheapest route between the western European capitals and the growing China market. Moscow is also increasing in importance as a trade mecca for both European and Asiatic businessmen.

• **Vacation travel.** The "vacation with pay" policy of the USSR moves a tremendous volume of traffic to and from the Crimean and Black Sea resort areas. With extremely limited rail and water transport, the demand for air travel of this type is heavy. An indication of how Aeroflot is developing this vacation traffic is its adoption of the western type circle excursion trip with unlimited stopover privileges at a variety of cities along a closed loop with a 10% reduction under normal fares. The first of these circular excursions will be offered soon covering the Black Sea, Caucasus and Crimea resort spots.

• **Family travel.** There is a surprising amount of this just plain "visiting" travel with family groups visiting relatives. The Soviet Union's population suffered a tremendous displacement during World War II through evacuation, forced labor drafts to Germany and prisoners of war, and with the limited post-war transport facilities available, much of this has never been unscrambled and produces a high volume of the "visiting" traffic.

The migration under pressure of large population groups, particularly younger people, to settle virgin lands, open new cities in Siberia and exploit the still vast Soviet frontier areas is

another social phenomenon that generates air traffic. The exploitation of Siberia's as yet uncataloged natural resources and the resultant industrial development will generate a major requirement for expanded air traffic capacity. In Siberia, the airplane and helicopter are the sole source of all-weather travel for the vast bulk of the territory, and Soviet policy is to use the helicopter and jet to open this frontier in the same manner that the covered wagon and the railroads opened the U.S. western frontier a century earlier.

In all of this type traffic the speed advantage of the jet equipment is generating new traffic, as it has elsewhere in the world where the velocity factor comes into play. For example, the Il-18 five hour nonstop service from Moscow to Alma-Ata competes with a five day trip by rail or a 14 hr., five-stop service by piston engine Il-14. The three-hour Tashkent-Tbilisi Tu-104B service establishes a travel link that didn't exist previously and would have involved a tortuous rail and sea combination. The Moscow-Krasnovodsk Tu-104B three-hour nonstop service bridges a similar gap, competing with a rail-sea combination or an 11 hr. Il-14 flight.

It is difficult to equate the Aeroflot domestic fare level in terms of foreign exchange due to the various artificial ruble exchange rates. But with an average Soviet worker's salary of about 1,200 rubles a month, these domestic fares are well within the Russian traveler's economic grasp. Aeroflot is still planning further reductions in domestic fares as its turboprop eqpipment becomes more plentiful and is willing to support but not lead any international movement toward European-wide fare reductions.

Aeroflot is now aiming its most intensive sales pitch at the highly competitive international routes but is extending its passenger service improvement program to all jet equipment on both international and domestic routes.

The airline is acutely conscious of its lack of corporate identity in non-Communist foreign countries. Commenting bitterly on the extensive advertising campaign conducted in Cairo by CSA, the Czech airline, for its Tu-104 service, one Aeroflot official said:

"The Arabs think Aeroflot is a small branch of CSA and that the Tu-104 is a Czech plane the USSR is using."

The Soviet airline is pondering the techniques of western advertising campaigns and has created a public relations department. It is plastering Intourist offices, airports and foreign travel agencies with models of its jet transports and with four-color posters plugging the Moscow-Delhi, Moscow-Peking and Moscow-London services via Tu-104. Aeroflot also distributes a large colored poster of a Tu-104 soaring over symbolic landmarks of the foreign capitals the carrier serves, including the Eiffel Tower for Paris, the Taj Mahal for India and a Peking pagoda for China.

In the left hand corner of the poster is the Empire State building representing New York. When queried about this inclusion of the New York landmark, an Aeroflot official commented: "Soon we will be there and then we won't have to print a new poster."

Among other promotional items, Aeroflot distributes calendars and colored postcards of the Tu-104. Timetables, which three years ago were a top secret state document, are now distributed freely in four-color versions sporting the Aeroflot house flag, with contents available in both English and Russian. The English versions assure the traveler that:

The fastest jetliners, the Tu-104 and Tu-104A, serve international and domestic routes of Aeroflot. They will take you from Moscow to: Budapest in 2 hr. 20 min.; Copenhagen in 2 hr. 20 min.; Amsterdam 3 hr. 15 min.; Paris 3 hr. 45 min.; Cairo 7 hr. 5 min.; Delhi 7 hr. 55 min.; Peking 10 hr. 30 min. The Tu-104 and Tu-104A have brought the speed, smoothness and comfort of jet air travel to their passengers.

The timetables also spotlight the substantial speed-time advantage that Aeroflot's jet transport now offers over competitive international equipment such as the Super Constellation, DC-7 and Viscount. The Chinese airline is in the poorest competitive equipment position, using Il-14Ms and Li-2s (DC-3) on its Soviet services from Peking to Moscow and Urumchi to Alma-Ata.

International Competition

When Aeroflot initiated international operations to Scandinavia in 1955, it had only twin-engine, 21-passenger Il-12 equipment available. The Soviet airline then restricted Scandinavian Airlines System (SAS) to using its twin engine, 24-passenger Scandias on the Moscow run and refused to allow SAS to operate its DC-6s in Russia.

When Aeroflot began its Tu-104 international jet services, the objections to foreign four-engine piston equipment vanished. However, Aeroflot will again face a serious competitive equipment problem next year when the Moscow run will see British European Airways operating Comet 4Bs and Air France using the Caravelle. It is not unlikely that Air India will also use one of its Boeing 707s on the Moscow-Delhi route to compete with the Tu-104.

Aeroflot passenger service standards still have considerable room for improvement before they get competitive with western airlines, but the Soviet airline is pressing hard toward that goal. The hulking, indifferent 200 lb. stewardesses in red sweaters have been replaced by trim, neat girls obviously selected for weight, personality and general attractiveness. They wear dark blue uniforms trimmed with gold braid and gold-trimmed blue tricorn hats. Silver thread wings with hammer and sickle centers are embroidered on their jackets. Aeroflot has just organized a stewardess training school in Moscow to train its jet era types.

Route maps and position reports in both English and Russian are distributed in flight, and hot meals are served on plastic trays and dishes. The meals are edible but are pitched to the Russian cuisine with such breakfast items as beefsteak, rice, salami and cheese, rather than to the western taste.

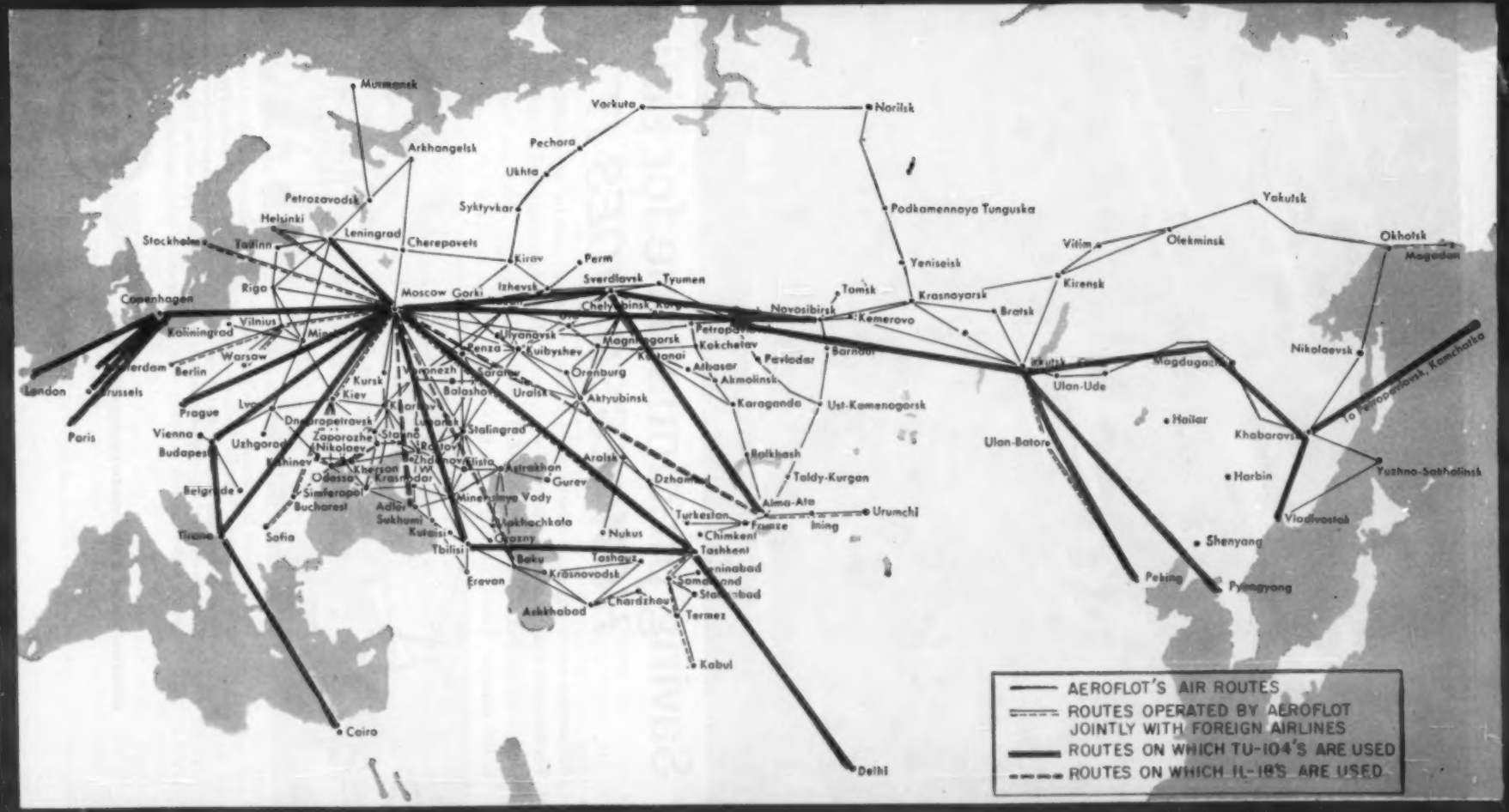
The pressure of international competition has also changed Aeroflot's attitude toward economy of operations and has snipped the interminable labyrinth of red tape required to get a Soviet visa. After opening service from Moscow to Delhi, Aeroflot found that its return flights were running almost empty despite the substantial time saving offered Delhi-London travelers via the Tu-104. The reason was the difficulty transit passengers had in getting Soviet visas. Now transit visas allowing a two-day stopover in Moscow can be obtained at the airline ticket counter, load factors are rising and British Overseas Airways Corp. is beginning to see considerable Delhi-London traffic siphoned off via Moscow.

Since all of the Iron Curtain bloc countries have been losing potential traffic through stringent visa requirements and security red tape, Aeroflot is now working on a plan, expected to be implemented shortly, extending this transit visa plan to Poland, Czechoslovakia, Hungary, Rumania and Bulgaria. Lure of the travel dollar, pound or franc is proving an effective acid to dissolve at least some of the traditional Communist security mesh.

Another indication of how the economy emphasis is growing in Aeroflot is its changing attitude toward the Brussels and Amsterdam services. Direct weekly Tu-104 service was inaugurated to both capitals last year. Now, with slim load factors, Aeroflot officials have approached both Dutch and Belgian governments regarding consolidation into a single Tu-104 service that stops at Brussels and Amsterdam. The Belgians agree if it stops at Brussels first, and the Dutch agree if it stops at Amsterdam first. Aeroflot is still serving both capitals directly.

(This is the second in a series of articles on Aeroflot, Soviet airline, jet operations based on interviews with Aeroflot officials in Moscow and on a 6,000 mi. trip around the Soviet Union flying in Il-18, Tu-104B and Il-14M transports.)

Route Map of Aeroflot



Pan American 707

Saving precious time for airlines:
HOW ESSO DOES IT!

All airlines see record expenditures in the jet age. Turn-around time is a major factor...extra minutes on the ground could cost hundreds of dollars in lost revenue. Esso is helping to cut this costly ground time to the minimum by supplying the fuels, lubricants and *service* that will assure airlines bigger dividends from their investment in jet age equipment.

To help speed turn-around, Esso pioneered safe, high-speed hydrant fueling—now in use at many major airports worldwide. And Esso developed large-capacity mobile refuelers with extra-fast pumping rates.

Esso service crews everywhere benefit from Esso's Jet Age Training Program—most advanced and comprehensive in the industry. *Wherever* you see the Esso sign, you can depend on quick, careful and competent service.

INTERNATIONAL AVIATION PETROLEUM SERVICE

Esso

SHORTLINES

► **Air India International** moved a step closer to an India-New York route last week when prehearing conference on its application for the route was held by the Civil Aeronautics Board.

► **Alaska Airlines** has been admitted to listing on the Pacific Coast Stock Exchange. The carrier, which is already listed on the American Stock Exchange, cited increasing interest in the airline's operations, which have set new passenger records in the past six months.

► **Allegheny Airlines** passenger load factor in June reached a record 55%.

► **Capital Airlines** has retained the industrial design firm of Lippincott & Margulies, Inc., of New York to develop a corporate image that will present the airline to advantage in the public eye. Main areas of study will be Capital's logotype, color scheme, general appearance, signs and symbols.

► **Eastern Air Lines** has indicated its intention to extend new experimental bargain fares of approximately 3.2 cents per mile to all days of the week beginning Aug. 7. Eastern recently filed with the Civil Aeronautics Board for a new schedule of night air coach tariffs good on Monday, Tuesday and Wednesday.

► **Ethiopian Airlines** showed a 1958 net profit of $54,197 compared to a profit of $56,072 in 1957. Operating profit in 1958 was higher than in 1957, but net profit was reduced in 1958 by higher interest expense deductions. The East African airline carried 92,712 passengers last year, an increase of 5.8% over 1957.

► **KLM Royal Dutch Airlines** has announced the sale of $13,157,800 in 20 year 4¼% bonds at 98% par value in the Netherlands. The issue will be listed on the Amsterdam Stock Exchange. In March of this year, KLM sold $18.5 million of 4¼% convertible subordinated debentures and has a $70 million credit with three U.S. banks of which $15 million was drawn down as of June 30, 1959.

► **Lockheed Aircraft Corp.** has rolled out its 75th turboprop Electra scheduled for delivery to Western Air Lines next month.

► **National Airlines** reported a 31.55% increase in first class passenger revenues at the fiscal year ending June 30 over fiscal year 1957. National expects revenues for the period to reach the $71 million mark, compared with $53,880,000 for the corresponding previous period.

AIRLINE OBSERVER

► Watch for a series of stormy sessions at the International Air Transport Assn. Traffic Conference which convenes Sept. 14 in Honolulu. Wide split among international carriers is expected to result from drive by British carriers, backed by full government support, for a world-wide extension of economy fares now in effect only on transatlantic routes. If the British fail to win a majority conference vote on the proposal, they will threaten to introduce the low rates on cabotage routes—routes that begin and end in British territory or colonies. Here is how carriers are currently split on other controversial issues in the North Atlantic area: Six out of 16 airlines want an elimination of round-trip discounts. Nine of the group are opposed to a jet surcharge, one is undecided. Five want a reduction of economy fares, four want a promotional type of fare designed to lure new business.

► **Air France and the privately-owned TAI (Transports Aeriens Intercontinentaux) have reached an agreement that will permit reopening of talks on the French-U. S. bilateral agreement. Air France will support TAI's bid for landing rights at Los Angeles on a nonstop route from Tahiti, while the private carrier will recognize Air France's exclusive rights to West Coast points on routes via the North Pacific and the Atlantic. Talks between the two countries on the bilateral broke down last year when France denounced the pact (AW Nov. 17, p. 38).**

► United Air Lines will sell or lease surplus piston-engine aircraft rather than convert them to turbine power. According to United's President W. A. Patterson, installation of turbine power in Douglas DC-6s or DC-7s "does not appear either economically sound or feasible from an engineering point of view" at the present time. He admitted the decision could be revised "if conditions should change or new developments occur."

► **Capital Airlines' overhaul life on the Rolls-Royce Dart engines which power its Vickers Viscounts has been extended to 2,100 hr.**

► Russia is subtly extending its aviation influence into Afghanistan under its program for aid to underdeveloped nations. At Afghan government request, a fleet of Soviet planes recently conducted a month-long locust-spraying campaign in the northern part of the country. Russian construction work at Kabul Airport (AW Dec. 8, p. 44) is expected to be followed by increased Soviet airline service to the Afghan capital.

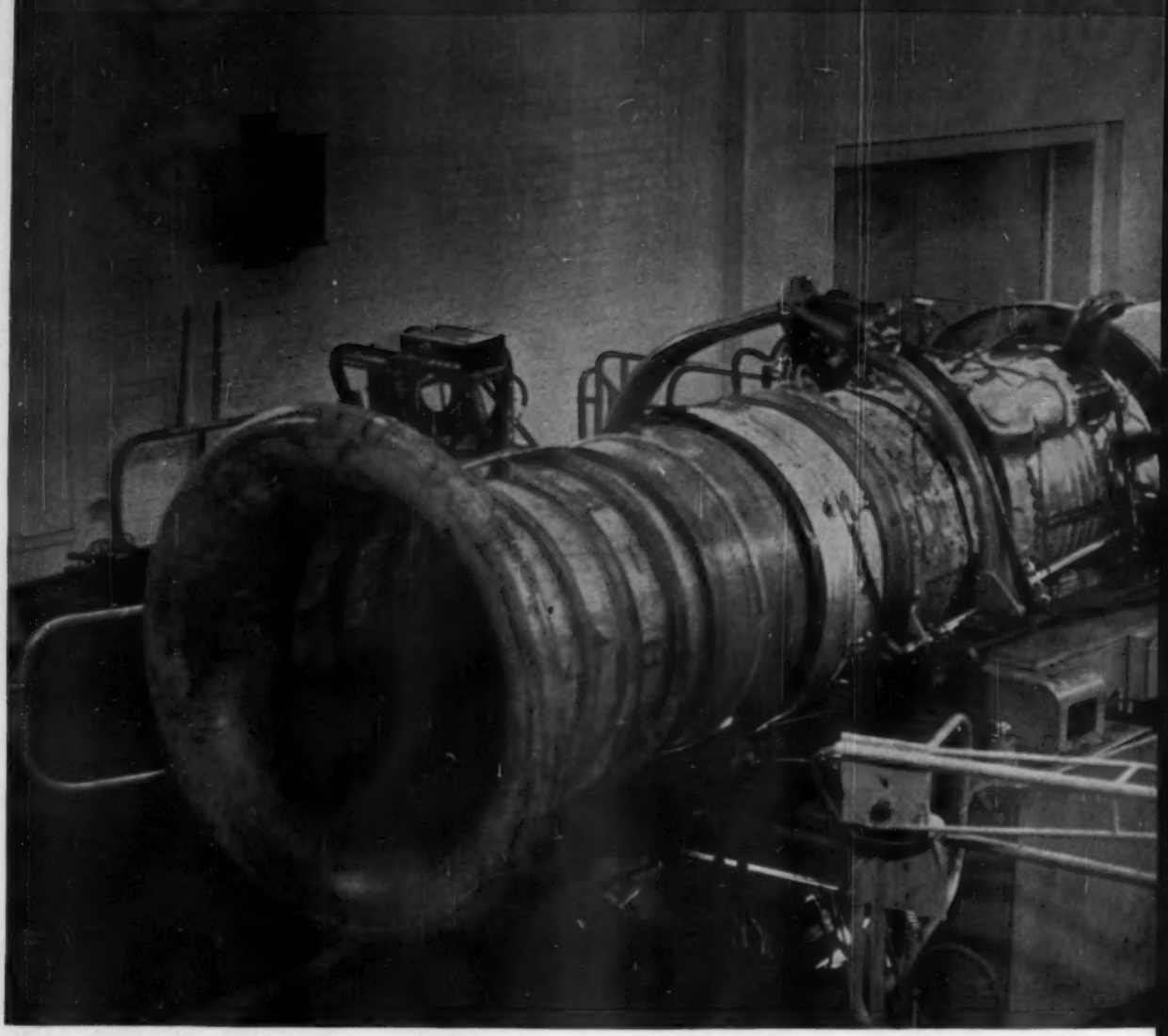
► **Federal Aviation Agency Administrator E. R. Quesada has served warning that use of funds granted under the 1960 Federal Airport Act will be restricted to construction essential to air safety. He said this policy may not rule out federal aid for terminal building construction but added, ". . . I can say that no such construction will be approved by me as an eligible project cost if it means that a safety requirement must remain unsatisfied."**

► Department of Defense and General Services Administration will offer 110 Air Force C-46 transports for sale within the next 60 days at fixed prices ranging from $50,000 to $60,000 each. GSA will extend credit to buyers who will base the planes in the U. S. or territories at terms of 5% interest with a down payment of 25% and the balance payable over a three year period in equal monthly installments.

► **United Automobile Workers President Walter Reuther has called upon the Defense Department to produce more cargo airplanes to "repair the vulnerable gap in our defenses" and to help ease unemployment.**

► Final traffic reports prepared for the month of June by the Air Transport Assn. show a 14.7% gain in revenue passenger miles for the domestic trunklines during the month compared with June, 1957, as first forecast by AVIATION WEEK (AW July 13, p. 36). Load factor for the month hit 68.1%, an increase of 5.32 points over the previous June. Coach traffic in June showed the biggest gain with a 16.9% increase in revenue passenger miles, compared to a 12.9% rise in first-class traffic. Coach load factor was 73% compared to a first-class load factor of 64%. Available seat miles for both classes of traffic reached an all-time high of 42 billion.

Bristol Siddeley Olympus delivers



Reheat version more than doubles power output of less than three years ago; demonstrates great potential of the Olympus design.

Less than three years ago the Olympus Mk 101 entered RAF service as the powerplant of the Avro Vulcan and was rated at 11,000 lb dry. Rapid development soon resulted in the Mk 200, producing 16,000 lb dry; while today's Mk 201, selected for the improved Vulcan B Mk 2, develops 17,000 lb dry, and 24,000 lb with Bristol Solar fully variable reheat—in still more advanced versions, will be increased to around 30,000 lb.

Olympus design not only gives high power for low weight. As Vulcan performance clearly illustrates, it secures three further valuable advantages.

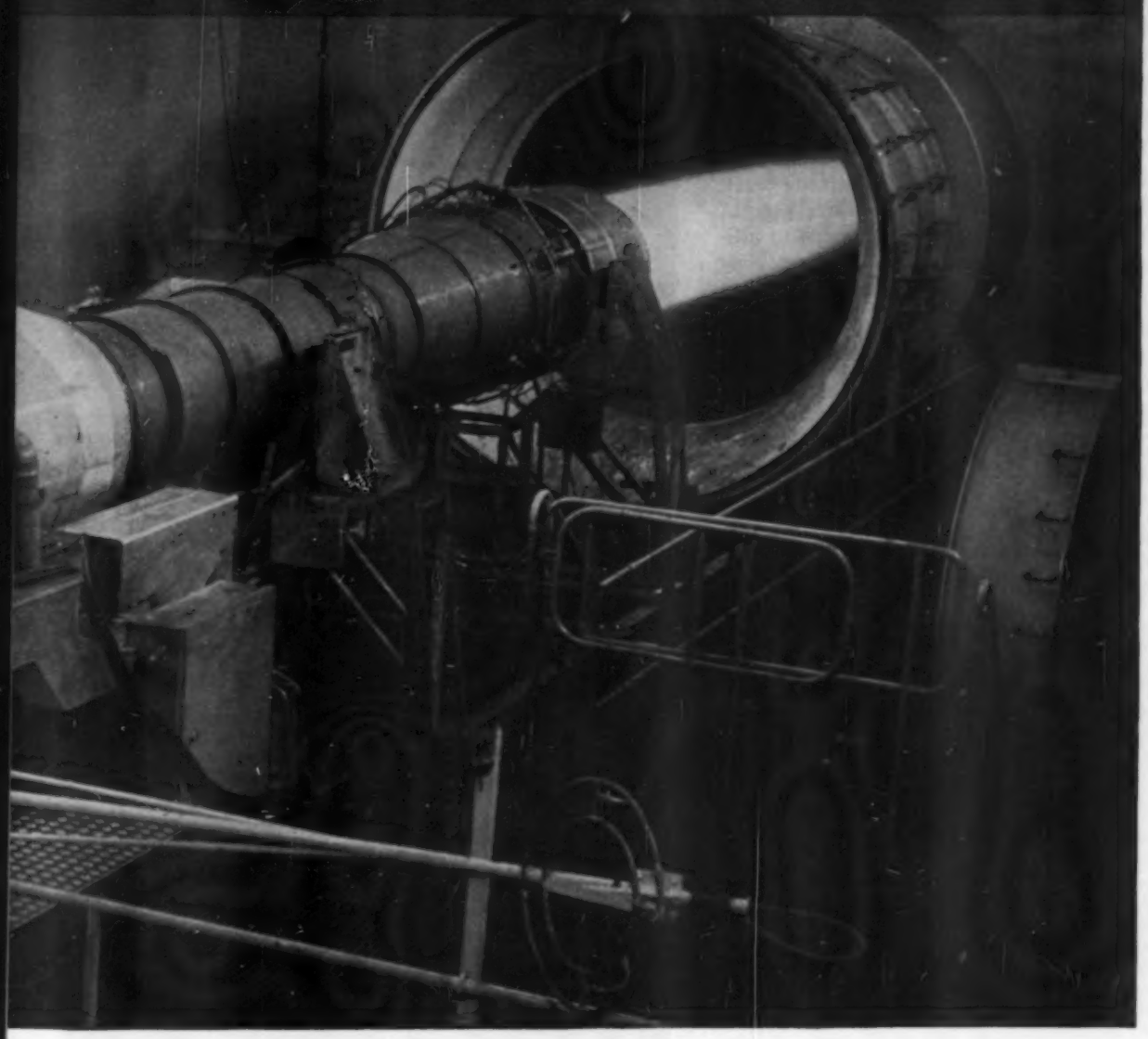
1. Great power at great height.

The Olympus maintains a high cruising thrust for the Vulcan at altitudes above 50,000 ft.

2. Low fuel consumption.

The Olympus gives the Vulcan immense flight duration. It has flown the Atlantic non-stop, from Farnborough to Toronto—3,566 miles—against the prevailing winds, at a point-to-point speed of well over 500 mph.

24,000-lb thrust



3. Outstanding reliability.
In a series of overseas flights, UK-based Vulcans have flown as far afield as the United States, Rhodesia, South America and New Zealand, to pre-arranged schedules. Such was the confidence in the Olympus, that, on the great majority of these flights, no provision was considered necessary for any engine spares whatsoever away from the aircraft's home base.

The handling characteristics of the Olympus have also received the highest praise. According to an official report, "... the Olympus sets a standard of handling at altitude which has never been equalled by any other turbine engine."

Latest achievement in the Olympus story is its selection as powerplant for the new TSR-2 strike reconnaissance aircraft.

Bristol Siddeley

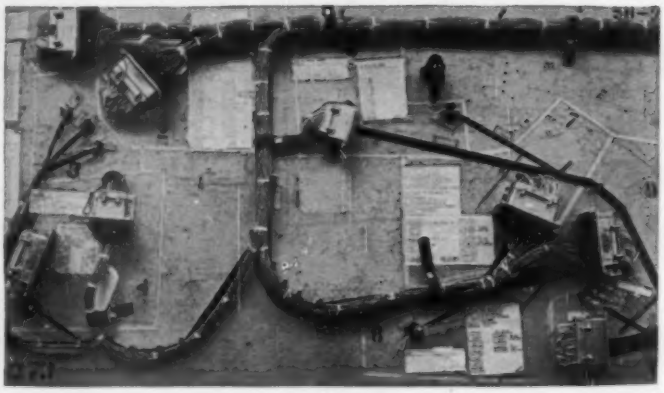
ENGINES LIMITED

The PLANE

Convair's B-58 Hustler, supersonic delta-wing bomber. The B-58 is a high altitude craft, area-ruled for Mach 2 flight . . . capable of attaining altitudes above 50,000 feet. Now in production for USAF.

The PROBLEM

Insulation for the B-58's electrical wiring system must be flexible, solderable, withstand extreme temperatures, ozone, moisture, arcing, corona. Must meet MIL-W-8777 specifications. Wire bundle clamps must remain resilient under same extremes.



The PRODUCT

SILASTIC

Wire covered with Silastic®, the Dow Corning silicone rubber, was specified throughout in the B-58. Wire bundle clamps are also Silastic.

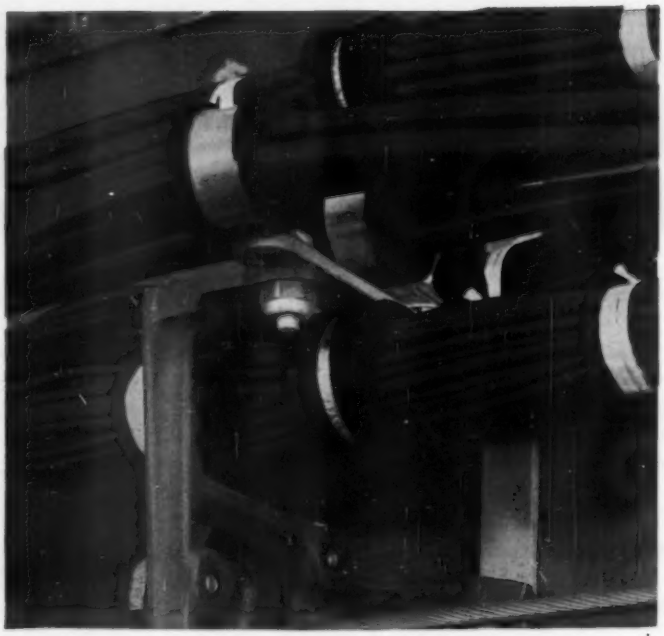
TYPICAL PROPERTIES OF SILASTIC FOR WIRE

Temperature range, °F	—130 to 500
Insulation resistance, megohms/1000 ft.	1000 to 3000
Electric strength, volts/mil	300 to 500
Dielectric constant, 10^2 cycles per second, nominal	3.2

For more information write Dept. 0919.

first in silicones

Dow Corning
CORPORATION
MIDLAND, MICHIGAN



FAA Inspects Foreign Navigation Aids

By David A. Anderton

Geneva—Two Flight Inspection Groups of the U. S. Federal Aviation Agency are now operating in Europe and the Middle East, checking out navigational facilities in airways, terminal areas and airports.

Stationed in Frankfurt, Germany, and Beirut, Lebanon, the Flight Inspection Groups operate specially-equipped Douglas DC-3s converted into flying laboratories. Pilots and technicians of the Flight Inspection Groups are specialists in in-flight checking of airways, terminal and airport equipment, and can calibrate any of the standard current aids.

The Flight Inspection Groups are self-supporting; their operation does not cost the Federal Aviation Agency any money. Most of their work is on contract and is reimbursable on a government to government basis. A portion of their work is financed by International Cooperation Administration funds paid into the FAA.

Major Purpose

Major purpose of the group operations is to check air navigational facilities. As part of this over-all job, the groups can either calibrate existing installations or advise on the locations of future equipment. Their primary concern is to get navigation aids on the air, functioning properly and calibrated to International Civil Aviation Organization standards or better.

Basis for the calibration checks is the FAA flight inspection manual. There is little difference between its standards and those of ICAO. But what differences there are tend to give more rigid inspections under the U. S. standards than under international requirements.

One example: United States standards for the glide-path beam of an instrument landing system require the beam slope to be between 2½-3 deg. The same beam width must be between 0.8-1¼ deg. ICAO standards require the beam angle to be suitable for a reasonable rate of descent. The corresponding beam width is to be two-thirds of the angle of descent.

The following navigational aids and special facilities can all be checked by one of the Flight Inspection Group aircraft and crew:

- **Very high frequency** omnidirectional range (VOR).
- **Visual aural range** (VAR).
- **Low/medium frequency** long range.
- **En route air-ground** communications.
- **Directing finding** stations (DF).
- **Low and medium** range radio beacons (NDB).
- **Airport traffic control** tower operations.
- **Surveillance radar.**
- **Precision approach radar** (PAR).
- **Instrument landing system** (ILS).
- **Approach lights.**
- **Marker beacons.**

"We can do all these," said one of the group, "but what we'd really like to do is work ourselves out of a job. We'd like to sell these countries on the idea of doing their own checking with their own airplanes and their own laboratories."

Biggest problem in meeting this phase of the mission is the general lack of acceptance of the need to do the job. Some of the countries of the world have a rather lackadaisical approach to the niceties of calibration of an ILS or to the necessary coverage and accuracy of a VOR station.

"Once we get past that objection, there is almost always a lack of funds or of current technical capability," said a Flight Inspection Group technician.

Cost Factors

Money is a problem because of the high cost of duplicating and in some cases triplicating the avionic aids installed in the flight check airplane. The amount and volume of the full avionic gear demands a fairly large airplane, such as the venerable DC-3, which is in itself an expensive item to acquire and operate. But adequate work can be done with smaller airplanes, especially where it is not necessary to check every type of airways facilities and navigational aid. It is this latter capability that makes the Flight Inspection Group airplane expensive.

Converting the interior of the plane to a flying laboratory, complete with a recording and analysis station, is not cheap either. Maintenance and upkeep comes high on scientific instrumentation, and the skills may not be available locally.

But some of the cost can be defrayed by using technical support available from Flight Inspection Group. Wiring diagrams, handbooks, engineered installation drawings and similar items are available to governments and technicians who need or want them.

Technicians can be taught how to operate and keep operating the complex equipment in the DC-3's interior; for this reason, one of the phases of the Flight Inspection Groups' work is informal contact with their opposite numbers. Through this mutual approach to a problem, the know-how of the U. S. team can be quickly transferred to their counterparts.

It is also possible that one of the future functions of the team would be to train technicians formally. This has been suggested a few times.

Right now, many European countries and some Asian countries have their own flight check airplanes, doing the same kind of work the Flight Inspection Group DC-3s handle. Among those countries are France, Germany, Great Britain, Greece, India, Italy, Pakistan and Spain. The East African Union has a de Havilland Heron and is completing its equipment now. Nigeria has a de Havilland Dove. Flight Inspection Group has made available the engineering drawings of the avionic installations in its DC-3 to the East African group to ease them over the initial hurdles of planning and designing their internal layouts.

But even if Flight Inspection Group did its best selling job, some of the countries in Africa or the Middle East might never be expected to get their own flight check aircraft. "We'd try to lick that one by encouraging somebody else nearby to help them," said a Flight Inspection Group technician.

Airlifted VOR

Part of the group's equipment is an air-transportable VOR station which can be hauled around, set on site and operated to check the site effect. Siting of these stations is still pretty much of an art rather than a science, and about the only way to check the final choice is to start operating a station there. But to commit a permanent station before the characteristics of the site are absolutely known is a bit risky; hence the need for a mobile station.

Flight Inspection Group expects that future work will be all reimbursable, and handled on a government-to-government basis. They would expect to be assigned to check and calibrate the installations of a country after that country had formally requested that the U. S. team do the work. Right now, some of the Flight Inspection Group work is under the Point Four plan, where part of the foreign aid program includes work on a country's airways.

Such work is now going on in Turkey,

Here is a man you should know
he's a DELAVAN FUEL INJECTOR SPECIALIST

James R. Brucker specializes in injection devices using flow controls. He's a Senior Project Engineer with Delavan. And during his six years of developmental experience, his products have become bill-of-material items on some of the world's most advanced jet engines for aircraft and missiles.

It's specialized engineering talent like Jim Brucker's that has made Delavan first choice for fuel injection problem solving. If fluid metering and atomization are part of your product, take advantage of Delavan's specialized experience and proven ability to deliver aircraft quality. Send specifications to the address below for obligation-free recommendations.

DELAVAN
Manufacturing Company
WEST DES MOINES, IOWA
World's largest nozzle specialist

where a joint U.S.-Turkish team is establishing VOR stations and other facilities. In Point Four work, all checking and calibration work is to U.S. standards, as a requirement of the program.

"Don't get the idea we're trying to tell these countries how to run their navaids," one Flight Inspection Group man emphasized. "We are advisers. If they want us to tell them, we will. But most of the time our role is a consultant one, and we recommend practices."

The Lebanon-based Flight Inspection Group unit had their airplane here a few weeks ago for installation of Tacan and Bendix weather radar by Swissair's maintenance shop at Cointrin Airport. Brilliant in the new Day-Glo orange markings, the DC-3 is otherwise a standard FAA airplane except for additional HF communication equipment which is necessary in Europe, the Middle East, Africa and Asia.

Swissair technicians installed a new flight panel, designed by FAA's Oklahoma City office, putting the Bendix radar scope directly into the center above the console, and locating the controls for the units and the auxiliary black box on the console. Behind the copilot's right-hand seat about 15 running feet of shelf space and circuit breaker panels contain all the receiving equipment necessary to monitor the operation of a ground facility.

Recording and monitoring station for the avionics technician is immediately aft of the avionics bay on the left side of the fuselage. A patchboard panel enables him to hook in the input to any receiver in the plane, and to record these inputs simultaneously. Two more seats, storage space and a bay for an auxiliary power unit to generate the extra electrical power required complete the interior layout of the DC-3.

Northrop Delivers First Q-Ball for X-15

Edwards AFB, Calif.—First Q-Ball re-entry attitude sensor (AW June 8, p. 69) for the North American X-15 has been delivered to National Aeronautics and Space Administration here, by Nortronics Division of Northrop Corp.

Q-Ball is intended for use at hypersonic speeds which render other attitude-sensing devices useless because of the effects of aerodynamic heating and high dynamic pressures. All extreme high-performance flying in the X-15 will be done with Q-Ball.

Very fine attitude control will be needed to limit structural loads and aerodynamic heating and stay in the planned trajectory. The X-15 pilot will have a visual display of yaw and pitch angles measured by Q-Ball.

ICONORAMA, air defense situation display which will be installed at North American Air Defense Command headquarters, Colorado Springs, Colo., provides large-screen color presentation (left) of all aircraft tracks, identification information, weather and other battle data by means of a group of optical projectors. Manual input to Iconorama situation display can be introduced by means of tracing board and crosshair (right). After selecting desired projector, any movement of crosshair is duplicated on projector slide by corresponding movement of motor-driven projector stylus. Iconorama will also be installed at SAC headquarters near Omaha, Neb.

Plotter Displays Air Defense Situation

By Philip J. Klass

Colorado Springs, Colo.—Automatic plotting system which instantly displays an air defense situation in color on a very large screen will be installed here soon at North American Air Defense Command headquarters and at Strategic Air Command headquarters near Omaha.

The automatic display, called Iconorama, is expected to greatly speed the plotting of aircraft target position compared with the manual plotting technique which has long been employed. Iconorama, which also can be used for air traffic control and other dynamic situation displays, is the product of Fenske, Fedrick and Miller, Inc., Los Angeles, a subsidiary of Temco Aircraft Co.

Heart of System

Heart of Iconorama is a group of precision optical projectors whose images are superimposed upon a single screen to give a composite presentation. Within each projector is a small slide coated with an opaque surface and a tiny stylus in a transparent frame which is moved in a horizontal and/or vertical direction by two small servo motors. When the stylus is brought into contact with the slide and moved by the motors, it scratches away a path in the opaque coating, allowing light to pass through and be projected onto the central screen.

In this way an Iconorama projector can produce any desired flight path display of an airplane or other moving target, operating directly from radar or air defense computer signals.

The stylus can be instantly withdrawn from the recording material, by means of a solenoid which is operated by electric impulse, enabling the stylus to be repositioned for making a fresh trace on the same slide. This enables a single projector and stylus to handle a number of different targets on a time-sharing basis. It also enables the stylus to scribe numerals, letters or other symbols required for target identification.

Information can be manually entered into the Iconorama display by means of a tracing board with a small crosshair and pushbutton. Stylus of any selected projector can be made to follow the motions of the crosshair movement.

Four such plotter-projectors can display the tracks of 100 targets, updating each of the 100 tracks once every five minutes, the company says. If more targets or speedier updating is required, additional projectors can be used. Recent tests conducted by Norad indicate that a single Iconorama projector can handle the work that now requires six manual plotting board operators.

The moving target traces can be projected on a screen measuring 15 x 15 ft., or larger if required. Additional projectors are used to superimpose a map of the area on the moving target tracks, or to display such information as weather conditions, the location of nuclear detonations or other battle information. Each overlay information display can be color coded by means of a suitable filter in the projector. Filters also can be used to display friendly aircraft tracks in one color, unfriendly or unidentified tracks in another color.

Flexible System

One of the most attractive features of Iconorama is its flexibility. Information can be displayed or removed from the central screen at the flick of a switch, as desired by the battle commander. Furthermore, information removed is not permanently erased, but can be displayed again when needed. Fenske, Fedrick & Miller has also developed a modified version of a microfilm reader-printer which can quickly make 8½ x 11 in. paper copies of information contained on any display slide for permanent reference.

Another advantage of Iconorama is its ability to use conventional low-cost teletype circuits for transmitting display data to a remote site. At present, a closed-circuit television link is used to relay Norad manual plotting board information to SAC headquarters, at a monthly cost of more than $40,000. When Iconorama is installed, a $1,200 per month teletype circuit will suffice for this purpose, according to company officials.

Fenske, Fedrick & Miller also has developed a three-dimensional dynamic situation display using the same basic Iconorama principles. The three-di-

series 31 and 32

flow control

servovalves

with mechanical feedback

from MOOG:

New performance levels can now be achieved at environmental extremes in advanced aircraft and missile applications. These light, compact, reliable servovalves are available in quantity to your specifications. Consult Moog for precision electrohydraulic servovalves, servoactuators and integrated servosystems.

WRITE FOR CATALOG 310

MOOG SERVOCONTROLS, INC. PRONER AIRPORT, EAST AURORA, N. Y.

LEADING INNOVATOR AND PRODUCER OF ADVANCED ELECTROHYDRAULIC SERVOVALVES

mensional version, which permits the plotting of information in "X," "Y" and "Z" coordinates, is now in use at Army White Sands, N. M., and Navy Pt. Mugu, Calif., missile test stations for range safety operations.

Company's address is 12820 Panama St., Los Angeles 66, Calif.

FILTER CENTER

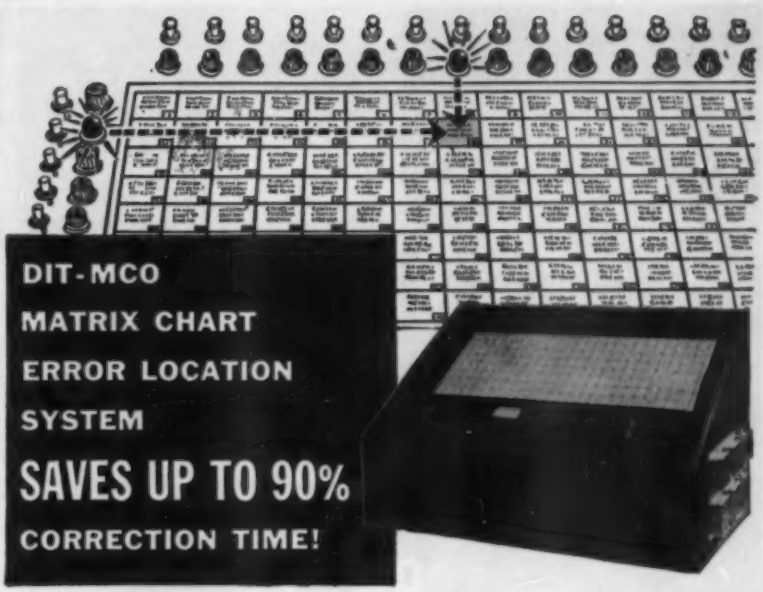
▶**New Name at WADC**—Electronic Technology Laboratory is the new name of Wright Air Development Center's former Electronic Components Laboratory. New name better reflects nature of its present mission and the trend toward molectronics (molecular electronics).

▶**Airlines Eye Automatic Landing**—Interest of U. S. airlines in flare-out adaptors, low-altitude radio altimeters and other instrument landing aids appears to be increasing, according to William Carnes, head of Arinc's Airlines Electronic Engineering Committee (AEEC). Britain's Standard Telephones & Cables, Ltd. has submitted proposed flare-out radio altimeter specification to AEEC and Carnes is sounding out airline members to determine if committee should draft an Arinc Characteristic.

▶**Computer to Speed Atlas Logistics**—Convair Astronautics Division has installed a RAMAC 305 computer, with a 10,000 character memory, to handle inventory control of spare parts for the Atlas ICBM. Computer will keep tabs on spare parts usage rate, inventory, decide when additional spares must be reordered. The IBM computer also will determine nearest and speediest source of spare parts currently in inventory.

▶**Airlines May Seek New Beacon**—United Air Lines is preparing specification for new miniature VHF transmitter for life raft use, following extensive tests which indicate that simplified, automatic beacon is needed for emergencies. Aeronautical Radio, Inc. will sound out airlines and if interest is sufficiently widespread, Arinc will prepare an industry characteristic (specification). Interested avionics manufacturers may obtain details on desired beacon characteristics by writing William T. Carnes, Aeronautical Radio, Inc., 1700 "K" St. N.W., Washington, D. C. Ask for AEEC Letter No. 59-1-53.

▶**Airlines Win First Round**—Airlines appear to have won first round in their battle with Defense Department over the use of 8,500 to 9,000 mc. for civil doppler radars. Newly prepared United States proposal, slated for the upcoming



Pinpoints All Circuit Flaws Instantly...Plots and Simplifies Test Procedure...Provides a Permanent Record!

DIT-MCO's revolutionary Matrix Chart is the only error location device which puts all circuit information . . . errors, circuit numbers, type of flaws, etc. . . . directly in front of the operator of this Automatic Electrical Circuit Analyzer. It plots the entire test sequence and pinpoints every circuit flaw . . . instantly! Horizontal and vertical indicator lights cross reference to indicate the exact error location, circuit number and type of flaw. As errors are detected, they are recorded on the proper matrix square and the test continues.

Once the test sequence has been completed, all corrections are made direct from the Matrix Chart. This group correction feature saves up to 90% of error correction and/or interpretation time by eliminating time-consuming searches through complex manuals and wiring diagrams. After corrections have been noted on the Matrix Chart, it provides a complete record of test circuits, test specifications, instructions, results and modifications. This concise, understandable record improves interdepartmental communications and provides co-ordination through all stages of planning, production and maintenance. Non-technical personnel easily master operation of the Analyzer and use of the Matrix Chart System. The final Matrix Chart can follow the product for future overhaul and maintenance use.

DIT-MCO, Inc. employs an experienced staff of sales engineers in the field. Contact your field sales engineer or write for important facts about DIT-MCO Automatic Electrical Circuit Analyzers.

PLUGBOARD PROGRAMMING SPEEDS TESTING!

Jumper-wired plugboard programming permits use of simple, straightforward adapter cables. Circuit modifications never present headaches because all changes are easily made by re-jumpering the readily accessible plugboards.

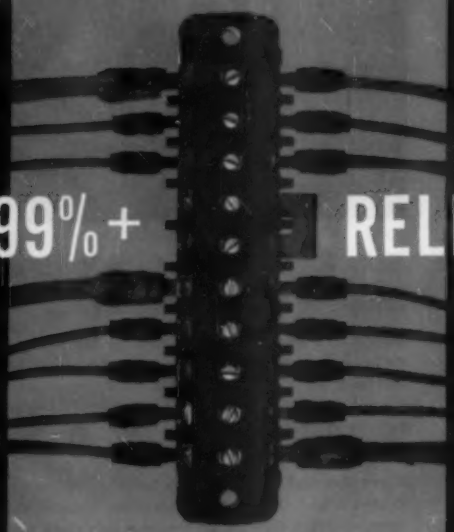
DIT-MCO, INC.

ELECTRONICS DIVISION • BOX 07-11
911 BROADWAY • KANSAS CITY, MO.

Partial List of DIT-MCO Users

Aircraft Radio Corp. ● AiResearch Manufacturing Co. ● American Bosch Arma Corp. ● American Machine & Foundry Co. ● American Motors ● Amphenol Electronics Corp. ● Autonetics, A Division of North American Aviation, Inc. ● Bell Aircraft Corp. ● Bendix Aviation Corp. ● Boeing Airplane Co. ● Cessna Aircraft Co. ● Chance Vought Aircraft, Inc. ● Chrysler Corp. ● Convair ● Douglas Aircraft Co., Inc. ● Dukane Corp. ● Electronic Products Corp. ● Fairchild Aircraft Division ● Farnsworth Electronics Co. ● Frankford Arsenal ● General Electric Co. ● General Mills, Inc., Mechanical Division ● General Precision Laboratory, Inc. ● Goodyear Aircraft Corp. ● Grumman Aircraft Engineering Corp. ● Hazeltine Electronics Division, Hazeltine Corp. ● Hughes Aircraft ● International Business Machines Corp. ● Jefferson Electronic Products Corp. ● Lockheed Aircraft Corp., Missile Systems Division ● Martin, Baltimore ● Minneapolis-Honeywell, Aeronautical Division ● Motorola, Inc. ● Northrup Aircraft, Inc. ● Pacific Mercury Television Mfg. Corp. ● Radio Corp. of America ● Radioplane Co. ● Raytheon Manufacturing Co. ● Servomechanisms, Inc. ● Sikorsky Aircraft ● Sperry Gyroscope Co. ● Summers Gyroscope Co. ● Sun Electric Co. ● The Swartwout Co., Autronic Division ● Temco Aircraft Corp. ● Thompson Products ● Topp Industries Inc. ● Trans World Airlines ● U. S. Naval Air Station Overhaul and Repair Depots ● U. S. Naval Ordnance Laboratory, White Oak ● Vertol Aircraft Corp. ● Western Electric Co. ● Westinghouse Electric Corp.

Now—the
TERMINAL BLOCK
with...



99%+ RELIABILITY

What makes a good terminal block?
Two things. One is quick connection.
The other is absolute dependability.
You get both in a Twin Lock Terminal Block.

Plug in the terminal lug and the connection is made and locked. One twist of the set screw and it's double locked. Fast? It's done in seconds.
Strong? It takes a hundred pounds of force to pull a lug out of its socket.
Positive? It has the least resistance of any mechanical connection.

Write for complete engineering data.

TWIN LOCK
INCORPORATED

1024 West Hillcrest Blvd. Inglewood, California
Telephone: ORegon 8-4773 • TWX INGL 8194
Coliseum Tower, 10 Columbus Circle New York 19, N.Y.
Telephone: Circle 5-8170 • TWX NY 14987

International Radio Conference, will recommend that this frequency band be allocated to "radio positioning service," as sought by the Defense Dept., but with a "footnote" which permits civil doppler radars to share the band providing users accept possibility of interference with military radio positioning equipments. Airlines are willing to accept joint use in view of recent studies by Federal Aviation Agency which suggest that there will be no harmful interference.

▶ **Varo, Fairchild Join Hands**—Varo Manufacturing Co., one of the pioneers in molectronic circuitry (AW June 2, 1958, p. 64), has worked out arrangement with Fairchild Semiconductors whereby the two companies will collaborate on future molectronic developments, with Fairchild concentrating in the area of semiconductor devices.

▶ **Busy As a Beaver**—International Business Machines Corp. reports that its Vanguard Computing Center in Washington has made more than 350 billion calculations since the center first began to compute orbits of earth satellites in October, 1957. Company estimates that a human calculator would have required 50,000 years to perform the same task, assuming he checked his work. The computer is an IBM 704.

▶ **Signed on Dotted Line**—Major contract awards recently announced by avionics manufacturers include the following:

• **Dalto Corp., New York,** reports that a Dalto Visual Flight Simulator has been purchased by Strategic Air Command for evaluation at Castle AFB, Calif., with a C-11 Link trainer.

• **Microwave Associates, Inc.,** Burlington, Mass., $151,000 contract from Navy Bureau of Ships for research and development in solid-state microwave techniques. Company also reports a $53,000 contract from Rome Air Development Center for investigation of design factors in gaseous discharge switches.

• **Beckman Instruments, Inc.,** $200,000 award from Aerojet-General for two data acquisition systems to be used in testing of solid propellant rocket engines for Minuteman ICBM. Fully transistorized equipment will be able to monitor test data at rate of 2,500 samples per second. Delivery is scheduled for next July.

• **Electronic Associates, Inc.,** Long Branch, N. J., $1.5 million subcontract from IT&T Laboratories for range instrumentation equipment to be installed at Eglin Gulf Test Range.

• **Sperry Utah Engineering Laboratory,** Salt Lake City, reports a $17.8 million contract from Army Ordnance for continued development of Army's Sergeant

THIS . . .

IS FLIGHT REFUELING, INC.

Integrated facilities for the study, development, testing and manufacturing of lightweight systems, sub-systems and components.

FAST FLUID TRANSFER SYSTEMS

(LOX, N_2, Hg, JP Fuels, H_2O_2, Heated Gases)

Air to air, ground to air, ground to ground, sea to air, sea to sea . . . from Av-gas to nuclear coolants. Accomplishments include ground fueling of Thor missiles and ship-to-ship refueling at sea.

AERIAL REFUELING SYSTEMS

FRI's years of designing and manufacturing Probe and Drogue Refueling Systems for all types of aircraft have resulted in the most advanced techniques in this specialized field.

CONTROLLED AIRBORNE SUSPENSION SYSTEMS

Suspension of various objects from airborne bodies. Projects include high speed target towing systems, trailing of dipping sonar systems, cable-laying cartridges and fire-fighting packages.

NUCLEAR ACTUATING MECHANISMS

Mechanisms for automated control rod actuation, valving and other fluid control in all types of installations. Automated fueling and defueling devices.

SERVICES -- ENGINEERING, MANUFACTURING AND TESTING

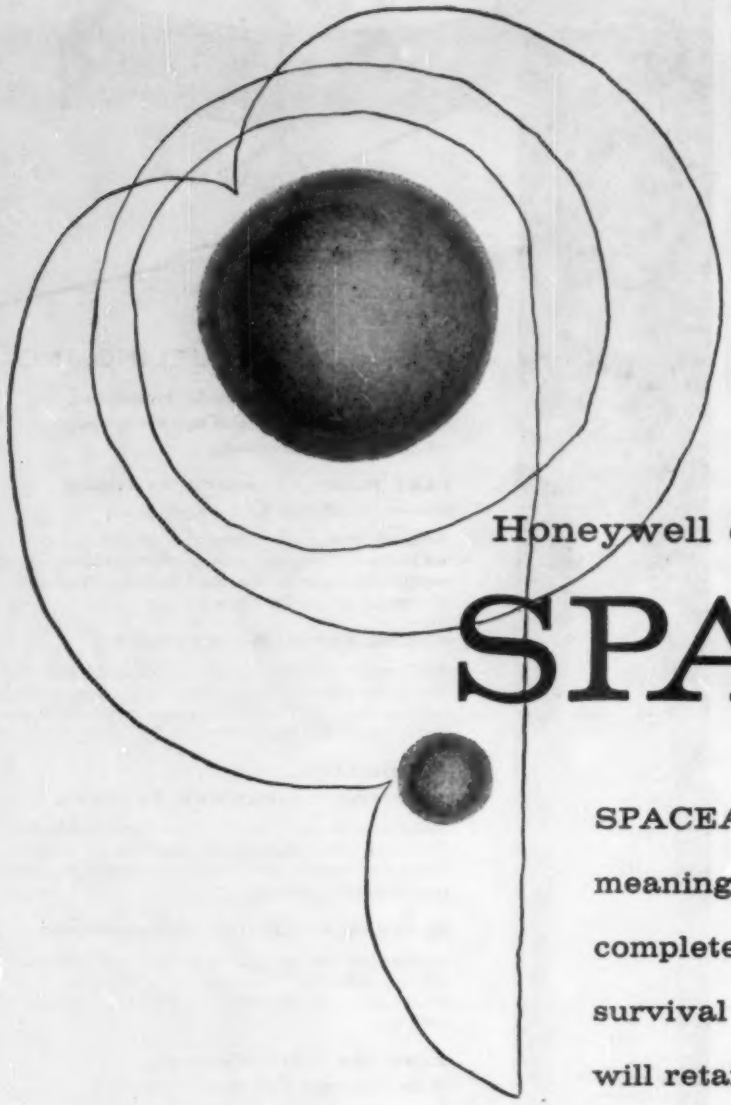
Complete facilities for production of sub assemblies and components to military specifications and environmental testing to MIL-E-5272.

Government and industrial contracts as scheduled and within budget limitations. Write for illustrated literature.

Flight Refueling, Inc.

FRIENDSHIP INTERNATIONAL AIRPORT • BALTIMORE 7, MD.

West Coast Representative: William E. Davis, Box 642, Inglewood, Calif.
Denver Representative: Price Engineering Sales Associates, Box 421, Littleton, Colorado



Honeywell calls it

SPACEA

SPACEABILITY is a new term meaning the capability to completely equip man for survival in space. While he will retain the ability to exercise his judgment with manual controls, man's welfare in space will depend largely on automatic control of his navigation, flight and power—in fact, his total environment, including food, oxygen and waste disposal.

There are three areas indispensable to space operations: (1) motion control and navigation for vehicles of flight, including inertial systems; (2) environmental control for human activity; and (3) instrumentation and data processing both on the ground and in the air.

Recognition of Honeywell leadership in all three areas is exemplified by the fact that Honeywell controls are going into almost all space vehicles presently planned.

BILITY

This Honeywell capability is benefiting the following projects, some of which have already been completed:

- Providing complete guidance and flight control system for Project Scout, the NASA launching vehicle for orbital and probe flights of instrumentation satellites.
- Developing navigation and guidance system for the proposed Martin version of Dyna-Soar, the Air Force pilot-controlled semi-orbital vehicle.
- Developing and producing an advanced space cabin environment simulator for the Air Force School of Aviation Medicine.
- Supplying orbital injection guidance reference systems for Project Vanguard's launching of satellites into predetermined orbits.
- Developing and producing attitude control for both orbiting and re-entry versions of Project Mercury, the NASA manned satellite program.
- Developing and producing attitude stabilization systems for vehicles used in re-entry test phases of Project Mercury.
- Human engineering studies and instrumentation development for pilot orientation in space flight for Project Mercury.

Corporate capability—With a notable background in missile and space systems management, as well as in the design, development and production of systems and components, Honeywell is fully qualified for work on all phases of prime missile and space systems.

Human engineering in relation to space flight is being studied by an entire project team at the Military Products Group's aeronautical facility in Minneapolis. The group is made up of specialists in anthropology, anthropometry, bio-chemistry, bio-physics, psychology and psycho-servo analysis. Their goal: optimum integration of man into a complex control system, which involves problems such as efficiently dividing labor between manual and automatic computation equipment.

Honeywell organization makes available to space projects unique capabilities and experience. These include Industrial Instrumentation, Computing and Recording complex; the services of environmental experts in the Temperature Controls Group; and associated members of the Military Products Group: Ordnance, Aeronautical, Boston, and Missile Equipment Divisions. The Corporate Research Center works closely with all groups.

Areas of interest and activity at Honeywell for space projects include the following:

Inertial guidance and navigation systems, gyros, stable platforms, accelerometers, computers, air data systems, ballistic trajectory control systems, horizon scanners, fix takers, reaction jets, control valves.

Other areas are flight data sensing and display systems, telemetry and recording systems, data reduction systems, pressure and temperature sensors, analog-digital and digital-analog converters, atmosphere composition control systems, temperature control systems, pressure control systems and recording devices.

If you have a problem that requires outstanding capability in control for space projects, call on Honeywell. For information write Honeywell, Minneapolis 8, Minn.

Honeywell

Military Products Group

Get transport performance at private plane price

install the powerful LEAR NAVCOM 100

The finest low cost airline type VHF navigation and communication equipment for private and executive aircraft.

Immediate Delivery

COMPLETE "A" PACKAGE

Transmitter, receiver, power unit, shockmount

$1095

COMPLETE "B" PACKAGE

190 Channel VHF Receiver
90 Channel VHF Transmitter
Power Supply — Modulator — Amplifier
Shockmount, including Connectors
VOR/LOC/Marker Beacon Receiver
VOR/LOC Indicator

$1495

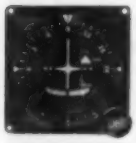
ILS ACCESSORIES
Add the new Lear Glideslope receiver including VOR ILS indicator complete for **$875.00**
(shockmount extra)

LEAR-LEARCAL DIVISION • 3171 South Bundy Drive, Santa Monica, California

THE NEW LEAR NAVCOM 100

Package "A" $1095.00

Includes 5611 Receiver, 5640 Transmitter, 2355 Power Supply – Modulator – Amplifier and Shockmount. Provides ample frequency coverage to operate your aircraft even in high density zones. 90 channel transmitter, 190 channel receiver, both crystal controlled.



Package "B" $1495.00

Adds the 2374 NavPac which provides VOR and localizer signals to the 4080 visual indicator. Also the 2374 provides 75 mc marker beacon signals to phones or speaker and to signal light indicators. Also adds the 4080 indicator which provides rotable omni-bearing selector, to/from indicator, localizer flag and direct reading reciprocal bearings.

ILS Accessories

Utilize all ILS facilities with the addition of the 10 channel, crystal controlled 5607 Glideslope Receiver and 4087 Indicator. This model 4087 indicator can replace the 4080 or be added. It provides glideslope presentation with individual flag alarms for the G/P and LOC. All this for an additional

$875.00 (shockmount extra)

See your Lear Distributor for an eye opening demonstration.

LEAR

LEARCAL DIVISION

3171 So. Bundy Drive • Santa Monica, California

surface-to-surface missile. Contract, which formalizes earlier letter contract, is in addition to recently announced award for $22 million.

• **Fairchild Astrionics Division,** Wyandanch, N. Y., $268,000 contract from Sperry Gyroscope Co. to provide engineering services for tests on Sperry AN/ASQ-42 inertial bomb-navigation system to be used on B-58.

• **Datex Corp.,** Monrovia, Calif., $332,000 contract from Japanese National Aeronautical Laboratory for digital data recording system to be installed at NAL's transonic wind tunnel. System will be able to handle 20 force data variables and 240 pressure data inputs. Company is subsidiary of Giannini Controls Corp.

• **Waste King Corp.,** Technical Products Division, Los Angeles, $48,000 award from Air Materiel Command for prototype quantity of pitot static tubes capable of withstanding exposure to temperatures of 1,400C for 15 min., for use on aircraft and missiles flying at speeds up to Mach 5.

• **Hermes Electronics Co.,** Cambridge, Mass. (formerly Hycon Eastern, Inc.) has received contract for more than $1 million from International Business Machines Corp. for timing equipment to be used in bombing-navigation system IBM is developing for use on B-70.

• **Avion Division** of ACF Industries, $193,000 contract from United Kingdom for radar beacons to be used in connection with Britain's long-range missile program.

Radio Device Detects Intruders; May Have Collision Avoidance Use

Washington—Novel radio device unveiled here recently was developed to detect intrusion into a secure military or industrial area and may also provide the basis for a lightweight, low-cost self-contained proximity warning indicator for air collision avoidance.

The device, known as a Standing Wave Area Motion Indicator, or Swami for short, was developed by Louis B. Mulvey, West Newton, Mass. Military Products Division of Singer Manufacturing Co. has obtained exclusive U. S. and Canadian rights to the invention. Swami systems already have been installed at several sensitive military/government installations to sound alarm in the event of intrusion.

Demonstration indicated that Swami is so sensitive that it can detect slightest movements of a human body.

Present models designed for intrusion detection weigh less than 10 lb. and cost under $1,000, including an alarm box.

The device consumes less than 5 w. of electric power, permitting battery operation for mobile applications like battlefield surveillance.

Singer has not yet contacted Federal Aviation Agency or Air Transport Assn. representatives to discuss Swami's potential air proximity warning application but plans to do so soon. Mulvey has conducted informal flight tests of the device and says he believes it can give a positive warning of an intruder aircraft, its position as well as its closing velocity. However, he says further investigation is needed.

Total weight of an airborne system should be under 35 lb. and its cost around several thousand dollars or less.

Although the U. S. Patent Office has not yet granted a patent, Mulvey says that discussions with the patent examiner indicate that several basic claims will be allowed on the new device. Until the patent is granted, Mulvey is reticent about revealing some details of how Swami operates.

Swami is neither a radar nor a doppler system. It consists of a low-power continuous-wave transmitter operating at a frequency of around 2,000 mc. The transmitter is pulsed at a repetition rate which can range from a few kilocycles to a few megacycles. Any movement of an object within the area of the radio frequency field produced by the Swami transmitter causes a change in the field pattern which in turn causes the transmitter's pulse repetition rate to change slightly.

A frequency modulation detector is employed to spot this change and sound an alarm. By counting the number of cycles of change per unit time, it is possible to determine the velocity of the intruder for applications such as an airborne proximity warning indicator.

The complete transmitter-receiver and FM detector for secure-area surveillance weigh only about two pounds, occupy about 20 cu. in. Transmitter output is 15 milliwatts. For airborne proximity warning use, a directional antenna and scanning mechanism would be required, increasing size and weight. Single Swami unit has an effective range of from a few inches to several thousand feet. With additional power, range could be increased considerably, Mulvey believes.

Mulvey is a self-taught electronics designer. He originally graduated with a degree in journalism, later became interested in electronics and worked for Raytheon as a production engineer. Swami was developed by Mulvey in his spare time over a five year period.

This is an actual photograph of 1½" Springfield "400" hose.

NOW!

design with large diameter

Teflon* hose that bends like this!

$6\frac{3}{4}$"

If you design fluid handling, transfer, or hydraulic equipment, you already know Teflon hose. Wonderful! Except, up to this time larger diameters were not really flexible. But *now* look!

SPRINGFIELD "400" WITH FINGER FLEXIBILITY
ONLY TITEFLEX HAS IT!

- **Minimum bend radius: *only 3⅓ times the hose diameter!* Thanks to the exclusive TITEFLEX process.**
- **Teflon innercore with all its properties. It's tough, lightweight, inert, resistant to corrosion and temperature extremes. Flex life is almost endless.**
- **Available now up to 2" in diameter, lengths to 25 feet (soon to 50!).**
- **Fittings prove failure-proof—right up to burst pressure of hose!**
- **In many cases, a shorter Springfield "400" hose can replace extruded hose at big savings.**

Springfield "400" has already made exciting news in scores of applications—new uses crop up every day. How about your field? Our bulletin will set design ideas clicking. Ask your TITEFLEX distributor (see the Yellow Pages) for a copy. Or drop us a line direct.

titeflex

Do these Springfield "400" applications suggest anything to you?

TANK, CAR, BARGE, MILITARY VEHICLE application • CHEMICAL • HIGH TEMPERATURE AIR • PLASTIC COMPOUND • HOT TAR AND ASPHALT • LIVE STEAM • CORROSIVE FLUID • HIGH TEMPERATURE HYDRAULIC SYSTEMS • AIRCRAFT: high temperature fuel and lubricating systems • MISSILE: fuel and oxidizer lines of vehicles and ground support •

titeflex inc. springfield mass. PACIFIC DIVISION • SANTA MONICA • CALIFORNIA

*Teflon is a duPont trademark
**T.M. of Titeflex, Inc., Pat. Pending

AIA Forecasts Aerospace Developments

Washington—Increasing heat environments in the next 10 years will force aircraft speeds to level off at about Mach 4 since skin temperatures will reach up to 2,000F.

Aerospace Industries Assn. made that forecast here in a report on scientific and engineering problems facing aerospace builders in the next decade. The sixth annual report, compiled by 200 research and engineering experts, also noted:

- **Re-entry velocities** for missiles, satellites and gliders will be such as to create short-time temperatures as high as 10,000F.
- **Maximum acceleration** for tactical missile thrust and maneuver loads will go from about 50 to 80g. In re-entry vehicles, g-forces will go from 150 to 170g.
- **Inertial guidance** and control systems will show a marked increase over non-inertial systems, and doppler-inertial and stellar-inertial systems will be in "considerable use by 1965" in second generation missiles and space vehicles.
- **Use of infrared guidance** systems in manned aircraft will increase in the 1960s but may be expected to "drop off markedly by 1970."
- **Reliable, gas-lubricated** spin bearings and refinement of electrostatic suspension for gyros and accelerometers must be perfected by 1965. Application of cryogenics, particularly in bearings, must be completed by 1970.

High Energy Fuels

In another phase of the report, the association stressed that improvement in air-breathing propulsion systems depends primarily on the development of high energy fuels and lubricants. Based on expected fuel developments, thrust efficiency of future rocket engines "should increase by at least 50% by 1970," researchers said, adding:

"However, with the development of free radical and nuclear powerplants, a 400% increase is possible. Development of these systems should result in their replacing chemical-fueled powerplants after 1970."

Turning to the manufacturing phase during the coming decade, the association pointed out that the time cycle from conception to production is becoming shorter while methods and equipment are becoming more complex. Some of the problems:

- **New materials will require** new facilities for handling and more complex processes will require better and more expensive equipment. Automation and numerical control "must be adopted on a wide scale."
- **Necessity for achieving** very close tolerances and improving methods of brazing, welding and heat treating in carefully controlled atmospheres.
- **Bonding requirements** will emphasize the use of ceramic adhesives; bonding steels will become commonplace.
- **Fabrication techniques** must be developed to shape steels with yields of more than 300,000 psi. and titanium alloys with yields of more than 200,000 psi.

Human Error

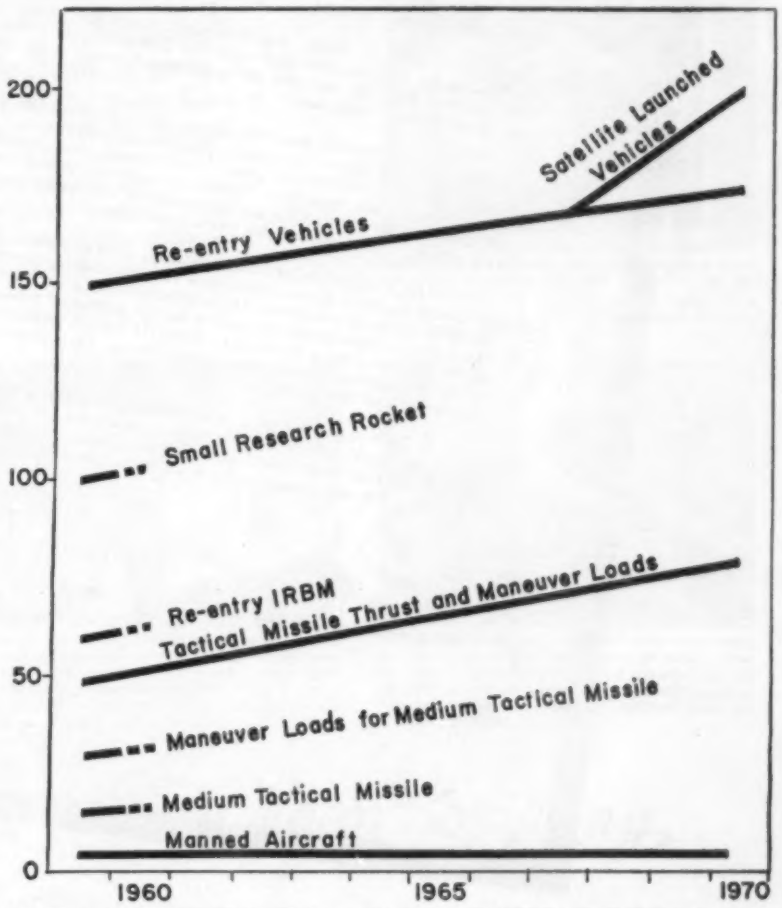
To eliminate the possibilities of human error in the coming era of extremely high precision, the association contended that complex testing procedures will have to be recorded on tape to automate systems testing.

The trend, according to the association, is "toward memory drums and storage devices that will be able to compare and make decisions" in accumulating test data. Equipment must be kept fairly simple externally to reduce operator skill requirements.

Two Major Categories

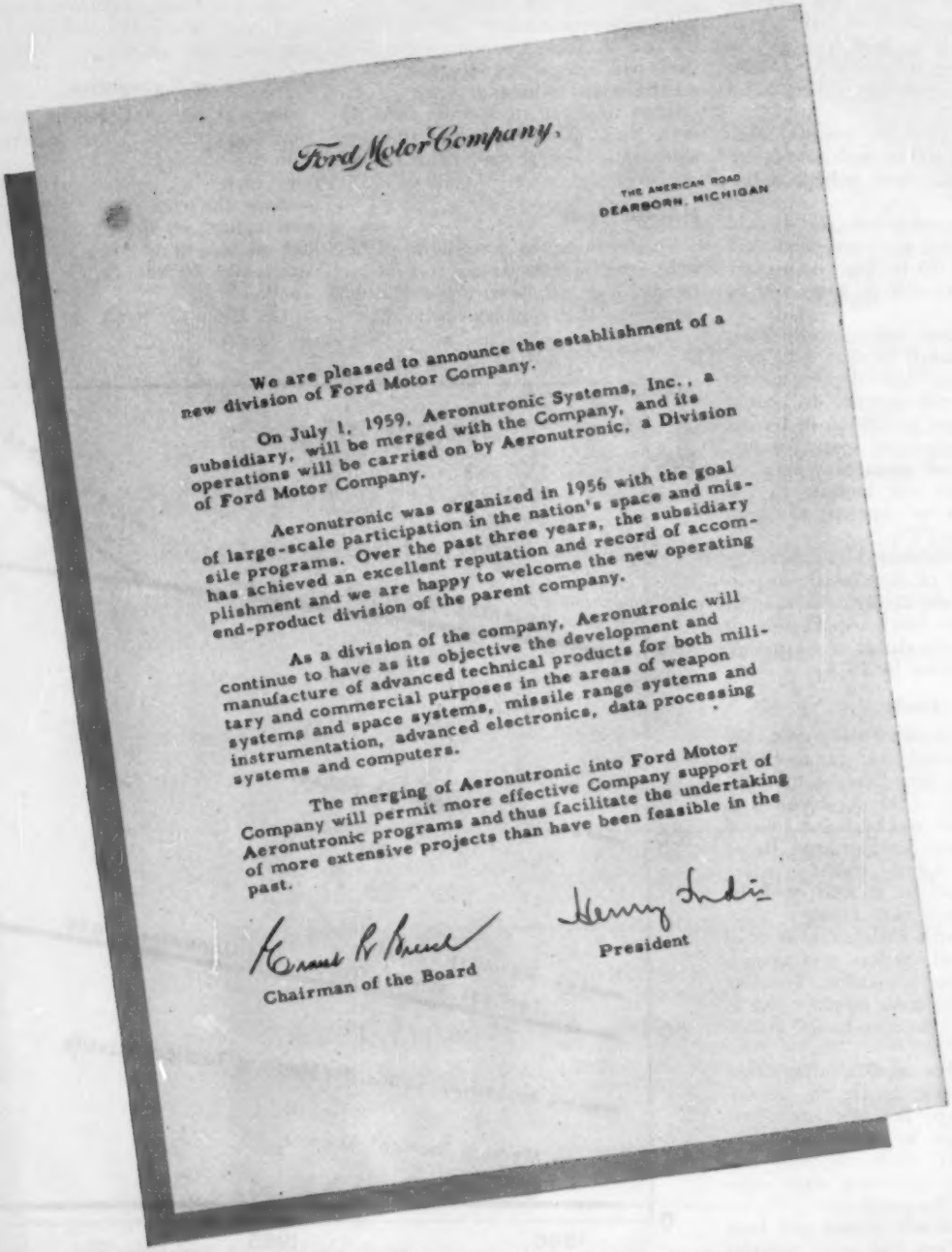
Because the development status of propulsion systems has been separated into two major categories—air-breathing and rocket systems—the air-breathing systems, the report noted, will "by their very nature, be limited to vehicles for the movement of large cargoes from one point on the earth's surface to another."

On the other hand, the association



G-FORCE THRUST, maneuver loads for tactical missiles will increase as designs are improved.

FORD MOTOR COMPANY DIVISION–AERONUTRONIC, FOR THE



Ford Motor Company,

THE AMERICAN ROAD
DEARBORN, MICHIGAN

We are pleased to announce the establishment of a new division of Ford Motor Company.

On July 1, 1959, Aeronutronic Systems, Inc., a subsidiary, will be merged with the Company, and its operations will be carried on by Aeronutronic, a Division of Ford Motor Company.

Aeronutronic was organized in 1956 with the goal of large-scale participation in the nation's space and missile programs. Over the past three years, the subsidiary has achieved an excellent reputation and record of accomplishment and we are happy to welcome the new operating end-product division of the parent company.

As a division of the company, Aeronutronic will continue to have as its objective the development and manufacture of advanced technical products for both military and commercial purposes in the areas of weapon systems and space systems, missile range systems and instrumentation, advanced electronics, data processing systems and computers.

The merging of Aeronutronic into Ford Motor Company will permit more effective Company support of Aeronutronic programs and thus facilitate the undertaking of more extensive projects than have been feasible in the past.

Chairman of the Board

President

AERONUTRONIC – MEETING THE REQUIREMENTS OF THE

ANNOUNCES A NEW SPECIALIZING IN PRODUCTS SPACE AGE

NEW 200-ACRE ENGINEERING AND RESEARCH CENTER. An artists' concept of Aeronutronic's new 20-million dollar Research Center under construction at Newport Beach in Southern California. Here, Ford resources provide the finest facilities for carrying out complete engineering, research and prototype manufacturing operations on advanced projects. Over 40 government and commercial programs are now underway at the new Center and at other Aeronutronic facilities nearby.

OFFICE OF ADVANCED RESEARCH. Basic research is conducted in areas of long-range company interests, with special emphasis in the fields of atomic and molecular physics, physical chemistry and atmospheric physics.

RANGE SYSTEMS OPERATIONS provides total capability to study and plan missile range instrumentation and to staff and manage complete missile range operations for U. S. military and civilian agencies.

TACTICAL WEAPON SYSTEMS OPERATIONS. The function of TWSO is to research, develop and manufacture tactical weapons for the military services. Under development now is the Army's $23-million SHILLELAGH surface-to-surface guided missile system.

COMPUTER OPERATIONS is engaged in research, development, manufacturing and marketing of computer components and communications systems for military and commercial use. New products developed are revolutionizing present data processing techniques.

SPACE TECHNOLOGY OPERATIONS is devoted to solving problems dealing with man's new frontier. Typical development programs include satellite communication, ICBM detection, space vehicle design and research rockets, such as Project Far Side.

For information regarding interests, facilities, products or positions, write to Aeronutronic, a Division of Ford Motor Company, Ford Road, Newport Beach, California.

Ford Motor Company

MILITARY AND INDUSTRY IN SCIENCE AND TECHNOLOGY

said rocket systems "possess the capability for providing 'super performance' within the earth's atmosphere or for operation outside the earth's atmosphere." But the report added that the rocket engine is still in the formative stages of development and "a clear superiority for application of solid or liquid propellant rockets for selected categories of vehicles has not yet been established."

Development of ion rockets and photon engines will, in the next 10 years, become accelerated when space flight by chemical and nuclear-powered vehicles becomes more frequent, according to the association.

In the metals field, the report said emphasis should be placed on development and application of refractory metal alloys. Trends indicate that alloys should be developed to have a usable strength at high temperatures and a ductile-to-brittle transition temperature of −65F or lower. At present, the researchers said, "it is apparent that beryllium falls far short of 1970 anticipated requirements," pointing to what they termed "poor weldability and lack of ductility."

Refinement of metals cleaning methods could make an appreciable cut in relative costs; etch cleaning now is comparatively new but is expected to reach maximum usage within five years. Other methods, expected to increase rapidly, are blast cleaning and vapor honing.

Ultrasonic cleaning still is being explored and potential for electro-erosion is "not well defined at present."

In a discussion of elastomers, the association predicted that use of butyl packings, O-rings and hoses will increase as phosphate ester hydraulic fluid

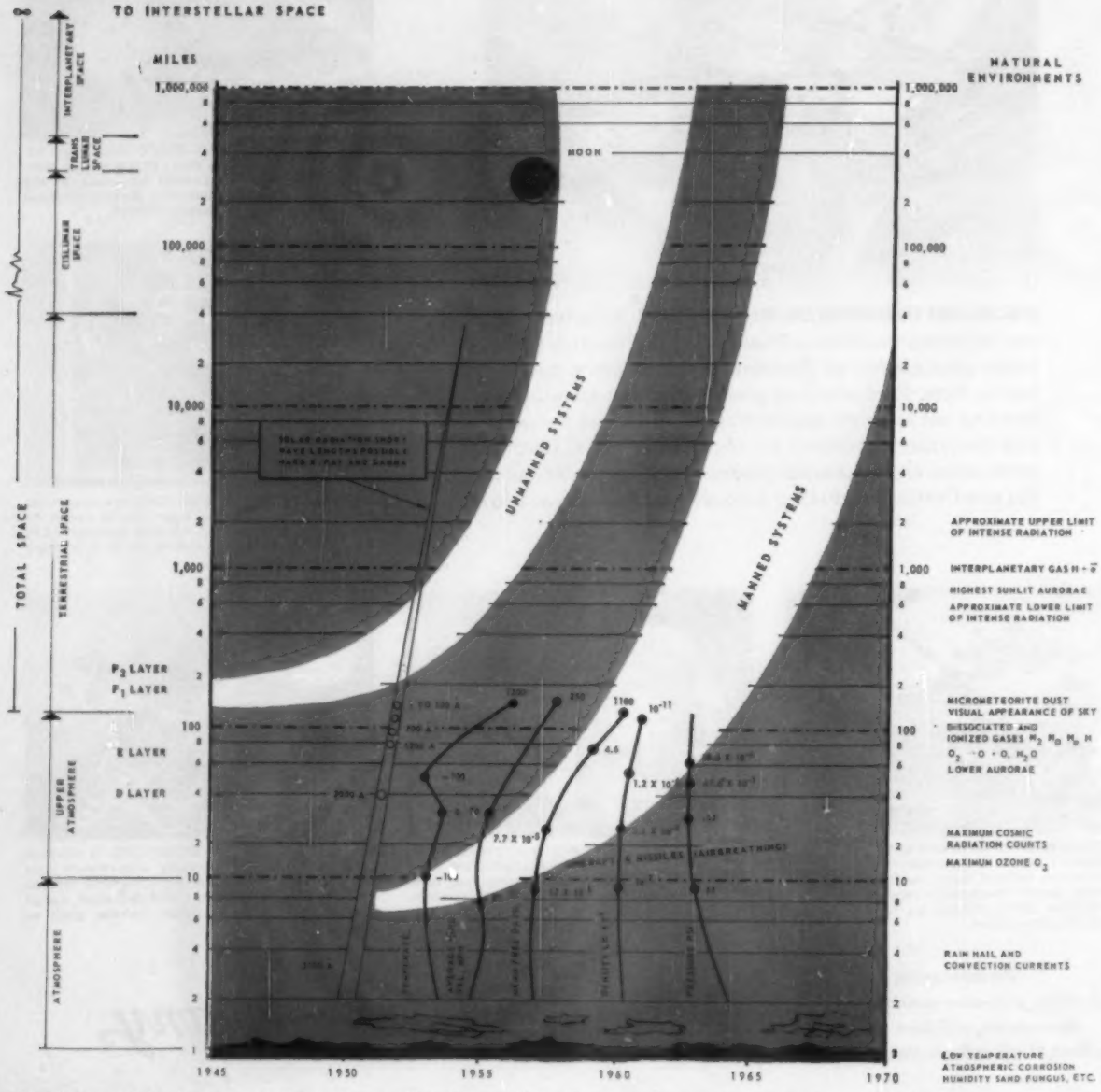


CHART prepared by Aerospace Industries Assn. technical committees illustrates advances forecast for the coming decade.

Go PAC... for aircraft & engine services!

TYPICAL AIRCRAFT SERVICES

- complete airframe modification & overhaul
- custom interior design & installation
- radio & radar installation & service
- electrical & hydraulic systems
- custom interior & exterior painting
- instrument installation & service
- Lockfoam soundproofing
- "wet-wing" fuel system expansion
- many other specialized services

PISTON ENGINES
SALE, EXCHANGE, LEASE, OVERHAUL
Fully covered by PAC's unequalled workmanship
WARRANTY
500 hours or 180 days!

ENGINES, ACCESSORIES, PROPELLERS... JET, TURBOPROP, PISTON

- engine overhaul, exchange, lease, sale
- accessory overhaul, sale & exchange
- propeller overhaul & assembly
- Pratt & Whitney Aircraft distributor & authorized overhaul shop
- only authorized Rolls-Royce Dart distributor & overhaul facility in the U.S.

PAC is the authorized distributor for major manufacturers of aviation products throughout the west.

For further information, call or write:

PACIFIC AIRMOTIVE CORPORATION

2940 N. Hollywood Way, Burbank, Calif.
Victoria 9-3481

PAC

SUBSIDIARIES:
PacAero Engineering Corp., Santa Monica
Pacair, Inc. (International) Burbank
Pioneer Leasing Corp., Burbank

consumption increases, but "may decline as tougher, heat-resistant silicone compounds appear.

"Fluorocarbons offer the best immediate answer for high temperature, high physical property, and fuel resistance," the report said. "However, fluorosilicones and nitrile silicones will provide stiff competition because of lower density where the better physical properties of the fluorocarbon rubbers are not needed."

Urethanes will find wide use as heat and fuel resistance improves. Use of natural rubber will decrease during the forecast period, to be replaced by the high temperature and ozone-resistant polymers.

PRODUCTION BRIEFING

Ryan Aeronautical Co., San Diego, Calif., will build the Q-2C, advanced Firebee target missile, under $8,667,000 Air Force contract. The XQ-2C is now undergoing flight tests at Holloman AFB, N. M.

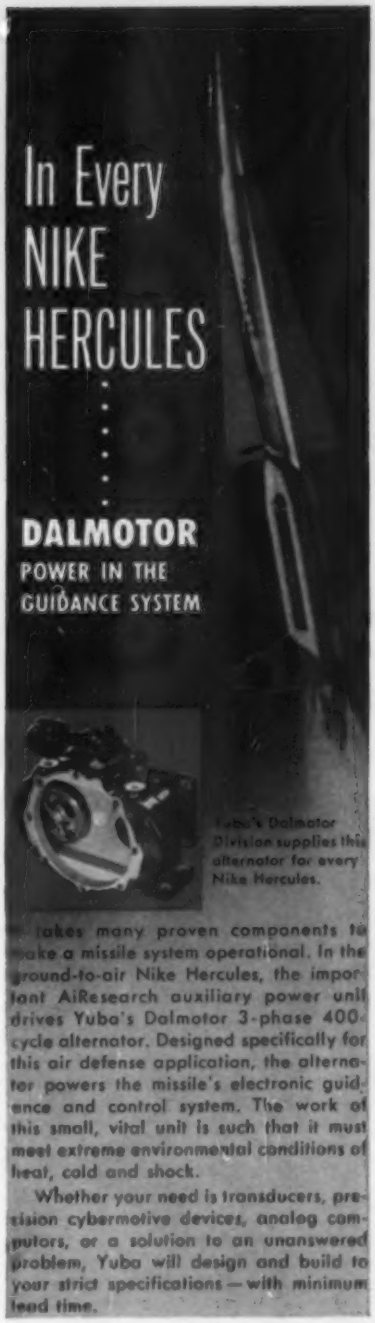
H. K. Porter Co.'s Thermoid Division, Trenton, N. J., will supply jet starter air hose to the Air Force under $1,255,000 contract. The hose carries air at temperatures to 500F.

Lockheed Aircraft Service, Inc., Ontario, Calif., will install Westinghouse J34-34 jet engines on Royal Australian Air Force Lockheed P2V patrol planes. The modification, the same as that done to U.S. Navy P2Vs, increases the aircraft's speed from 286 to 347 kt. at 1,500 ft. altitude.

Robertshaw-Fulton Controls Co.'s Aeronautical and Instrument Division, Anaheim, Calif., will continue production of helium pressure regulators for the Titan ICBM under $439,986 Martin Co. contract. Regulators control helium pressurization in fuel and oxidizer tanks of both the first and second stages of the missile.

Siegler Corp.'s Hallamore Electronic Division will build production test equipment for Hughes advanced air-to-air missiles under $250,000 contract. The equipment, a radio frequency signal generator, checks the radar guidance and control surface response of the missile.

Koppers Co.'s Metal Products Division, Baltimore, Md., will deliver three semi-portable noise suppressors to Chance-Vought Aircraft for use in testing Navy F8U fighters. The exhaust suppressors will be anchored to the ground and will be used in conjunction with three portable intake supressors.



Yuba's Dalmotor Division supplies this alternator for every Nike Hercules.

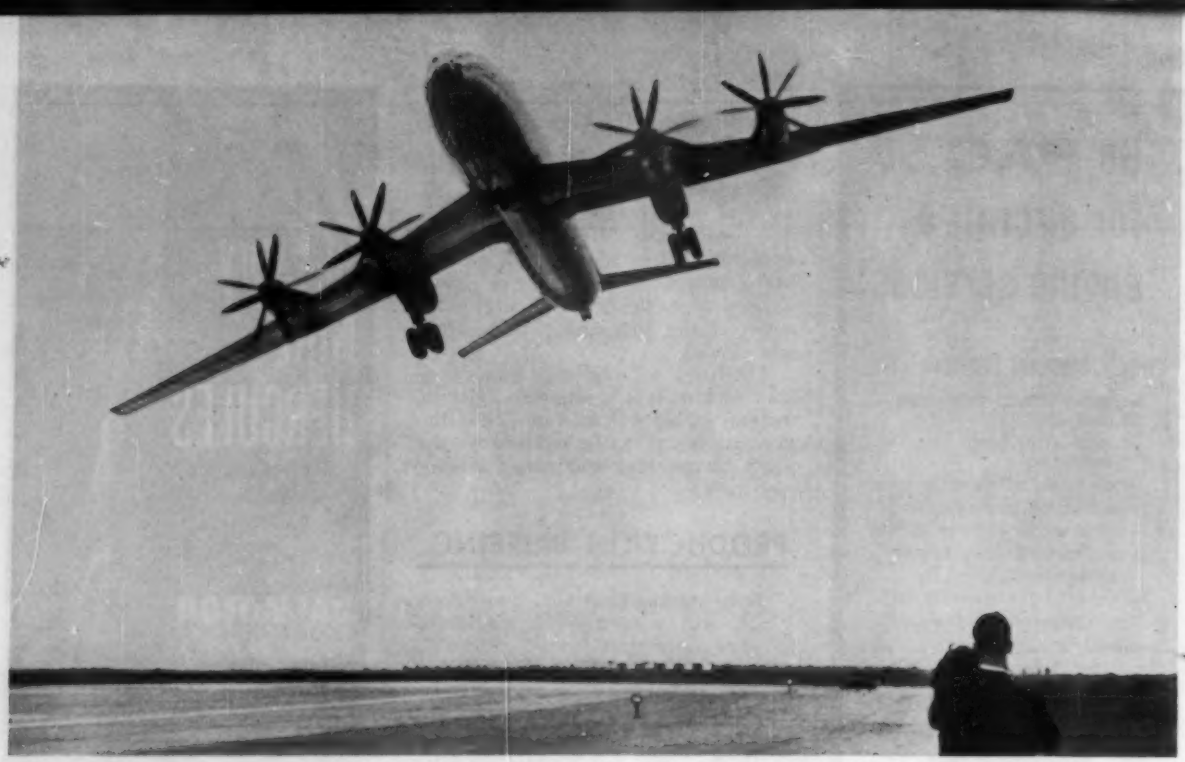
It takes many proven components to make a missile system operational. In the ground-to-air Nike Hercules, the important AiResearch auxiliary power unit drives Yuba's Dalmotor 3-phase 400-cycle alternator. Designed specifically for this air defense application, the alternator powers the missile's electronic guidance and control system. The work of this small, vital unit is such that it must meet extreme environmental conditions of heat, cold and shock.

Whether your need is transducers, precision cybermotive devices, analog computors, or a solution to an unanswered problem, Yuba will design and build to your strict specifications — with minimum lead time.

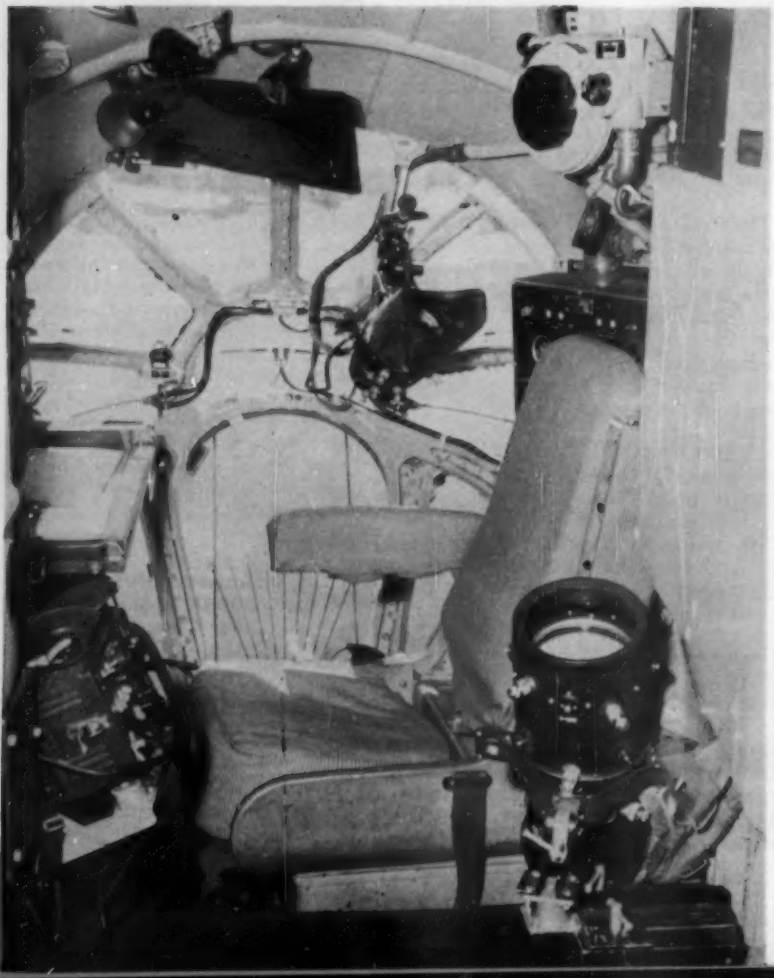
Dalmotor Division
1375 Clay Street
Santa Clara, Calif.

YUBA
YUBA CONSOLIDATED INDUSTRIES, INC.

Plants and Sales Offices NATIONWIDE

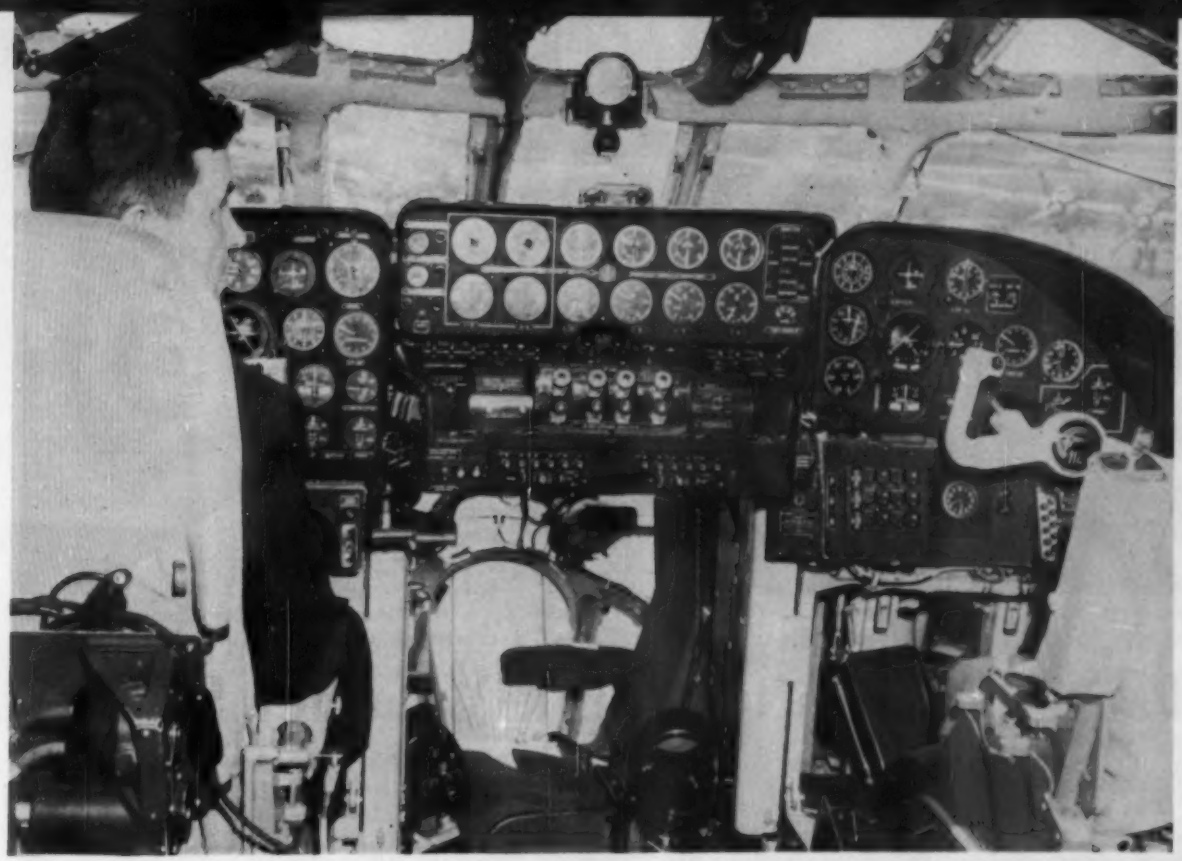


First Photos Show Soviet Tu-114 Flight Deck

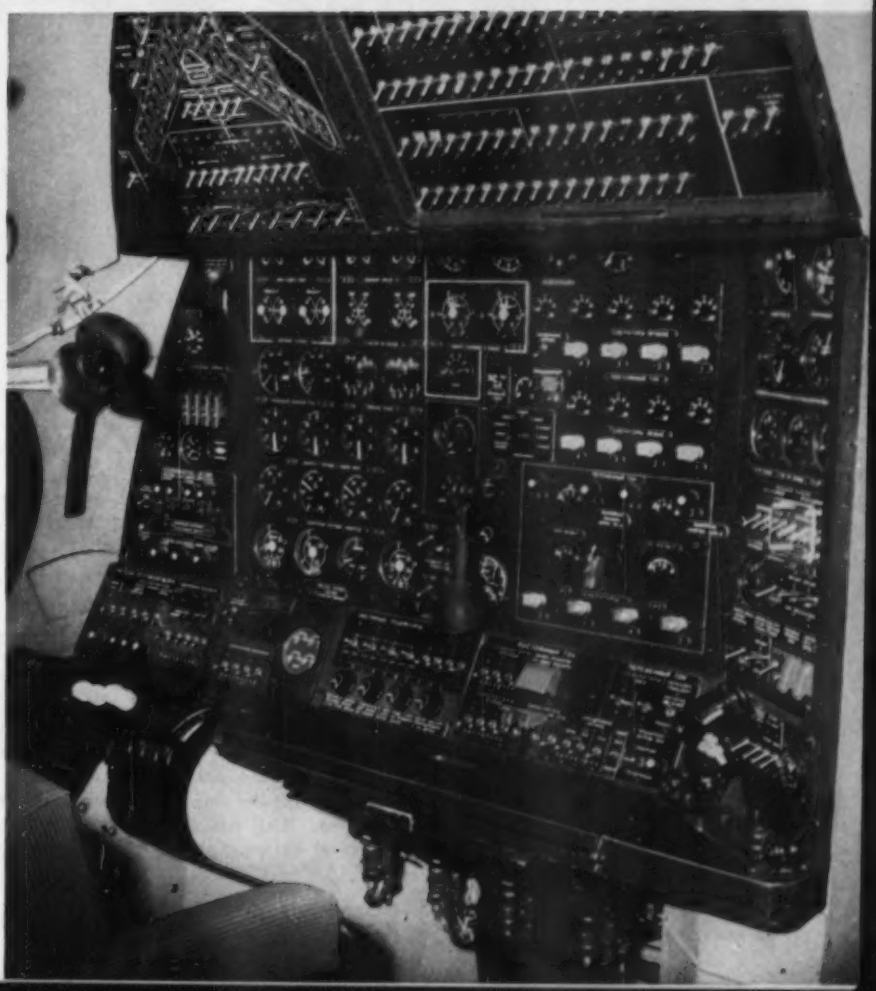


Transatlantic capability of Aeroflot's big 120-220-passenger Tupolev Tu-114 turboprop transport was demonstrated to the U. S. in two recent nonstop flights—Moscow-New York in 11 hr. 6 min. (AW July 6, p. 38) and the return trip in 9 hr. 48 min. last Monday. U. S. engineers were impressed by the scope of technical problems tackled by Soviet engineers, particularly the powerplant section embracing 12,000-shp.-plus engines and 18.3-ft.-diameter contra-rotating propellers. Propellers, which can be reversed, are electrically controlled, hydraulically actuated and have a pneumatic system—in case of power failure—to feather in less than three seconds. Near head-on view, at top of page, showing Tu-114 ia-itiating go-around when first radar approach at N. Y. International Airport was made too fast and too high, points up wide spacing of inboard engines from fuselage to minimize effects of propeller tip noise. Airplane arrived with enough fuel for four hours of further flight, had 16,000 gal. of Shell 640 kerosene-type fuel loaded before takeoff, an additional 2,000 gal. loaded during week.

Navigator's compartment in visiting Tu-114 nose featured extra scope (foreground, right) for use by American navigator who guided Soviet navigator during portions of flight. Navigator's scope is suspended in monorail permitting forward and rear travel, is hinged, to bring contoured facepiece to navigator's eye level while seated. Workbench is at left.



Tu-114's cockpit (above) appears to be more refined than military-style evident in Tu-104. Tu-114 control wheels jut from instrument panels. Captain's wheel has nosewheel steering wheel mounted in hub. Airplane control system utilizes hydraulic boost. Flight instruments are very similar to comparable U. S. types, include standard-type altimeter. Engine instruments are mounted in center panel above propeller feathering controls. Seats, mounted on tracks, are a step up from the floor and have hinged arms to provide ease access. Ash trays are built into the arms. Throttles, mixture and propeller controls are mounted on captain's left and copilot's right. Left and right windshields are electrically heated by metal strips.



Tu-114 flight engineer's station is behind the copilot. At top left is schematic system of fuel system. Engine controls are at lower left. Engine fire extinguisher control panel is located at left just below small fan, adjacent to engine instrumentation. Airplane electrical system includes a 28-v. d.c. layout with eight d.c. generators and four a.c. generators. Anti-icing of propellers and tail is electrical. All fuel is carried in wings; although Russians were reluctant to discuss tankage, U. S. engineers believe that integral tanks are fitted. Fueling of the aircraft is done at several points above the wings near the leading edges. The Russians tested the fuel, taking samples from the tank truck's sump.

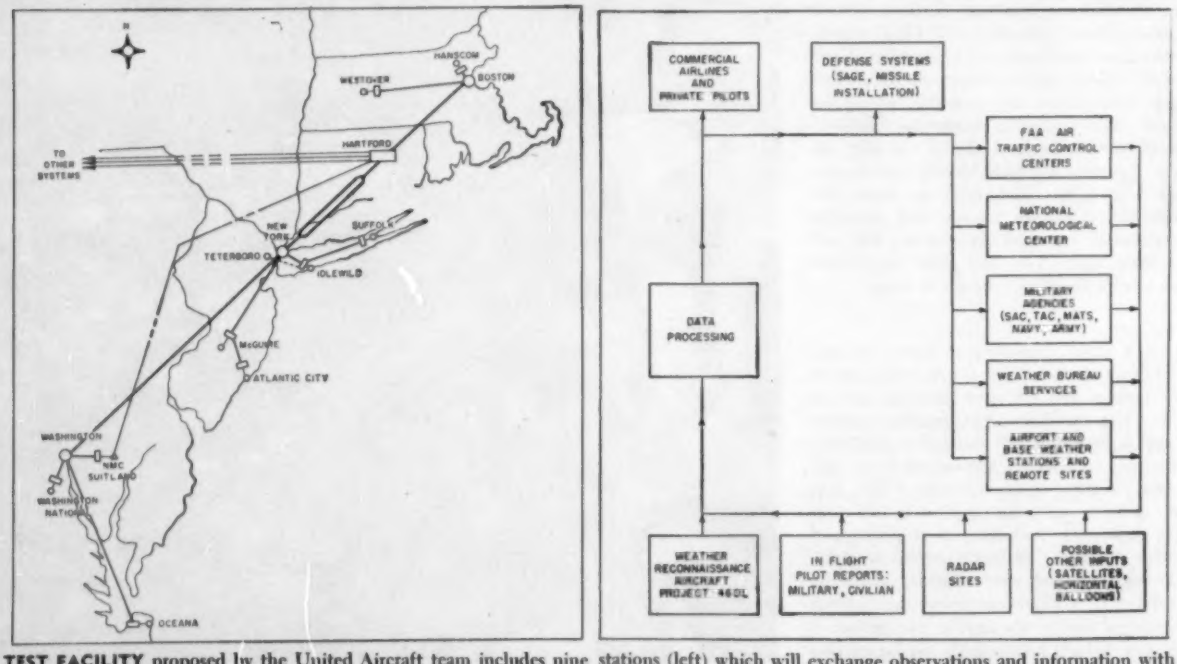
CONTROL PANEL designed by United Aircraft Corp. Research Department for its IBM 704 computer complex shows company's capability for adapting, using large computer systems in data processing work. Data processing is a key element in 433L weather system.

United Aircraft to Link Weather System

By Craig Lewis

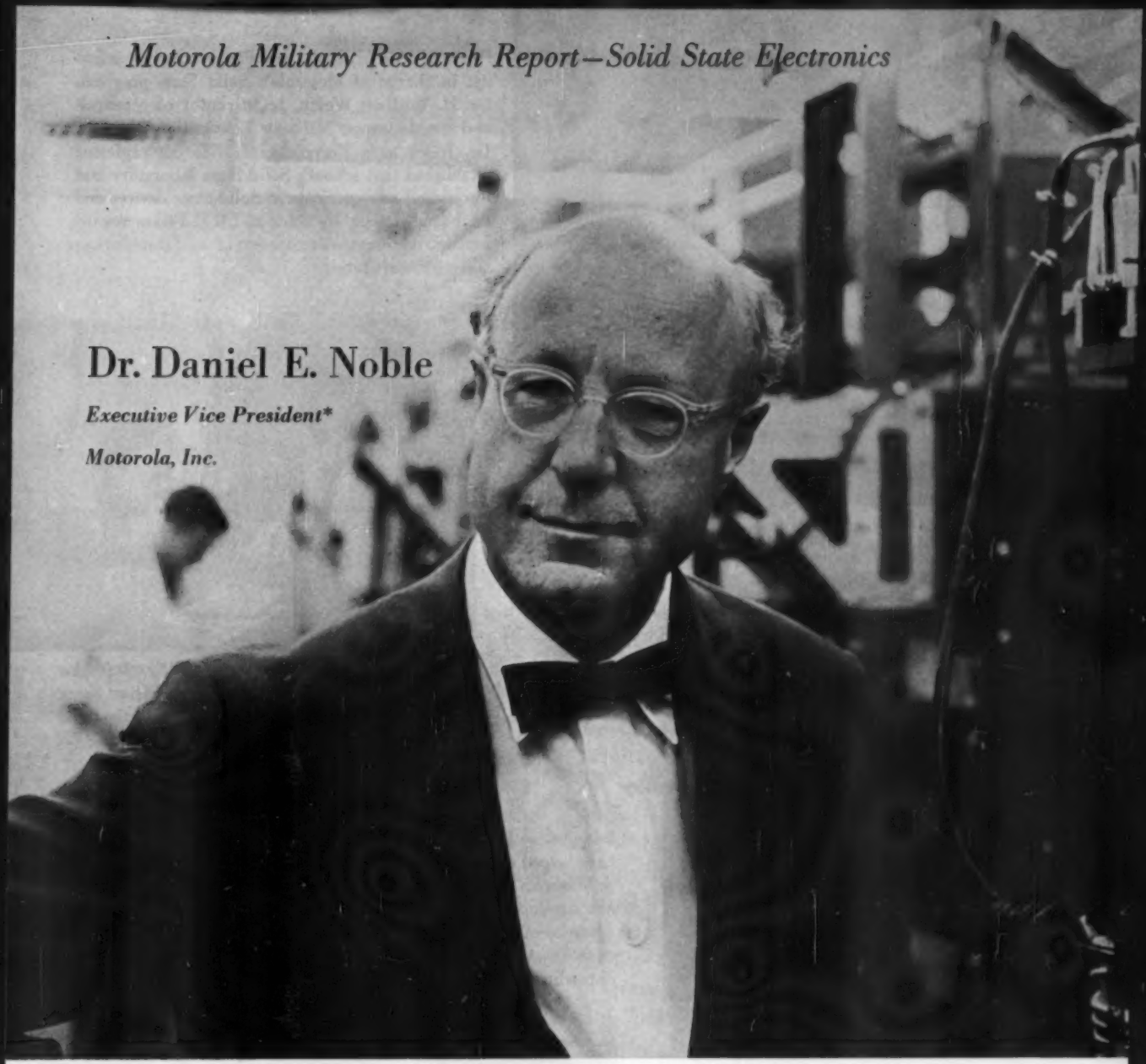
East Hartford, Conn.—United Aircraft Corp. is launching development of an integrated high-speed weather system which will eventually form the basis for a common military-civil national weather service.

Moving into the new field of weather system development, United Aircraft will work with a team of seven associate companies to establish a test facility which will include a data processing center and nine stations along the Atlantic Coast. Basic task is to integrate available equipment and techniques into a single system, Weather Observing and Forecasting System 433L, which can eventually be expanded into a common national weather system and a global Air Force weather system. In the actual job of developing the test facility, the UAC team will be using a number of pieces of equipment which have been under development by the Geophysics Research Directorate of Air Force Cambridge Research Center. As this integration work proceeds, the UAC group will also be doing research and engineering work aimed at improv-



TEST FACILITY proposed by the United Aircraft team includes nine stations (left) which will exchange observations and information with a central data processing center in Hartford, Conn. This test facility is scheduled to be in operation late in 1960. Information flow for 433L weather system (right) shows equipment and organizations which will be reporting observations, receiving weather reports.

Motorola Military Research Report—Solid State Electronics



Dr. Daniel E. Noble

Executive Vice President*

Motorola, Inc.

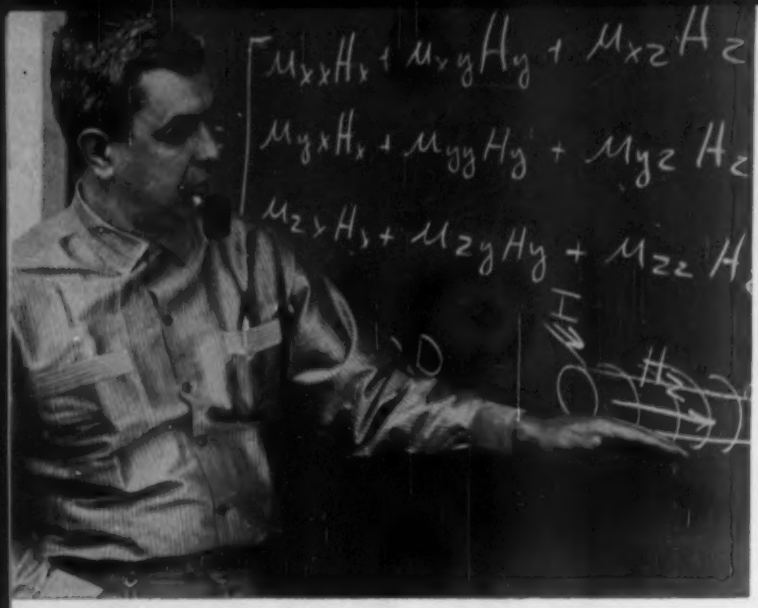
*DR. NOBLE IS VICE PRESIDENT IN CHARGE OF THE COMMUNICATIONS AND INDUSTRIAL ELECTRONICS DIVISION, THE SEMICONDUCTOR PRODUCTS DIVISION AND THE MILITARY ELECTRONICS DIVISION OF MOTOROLA, INC.

"In this new era, Solid State Electronics will spread its influence to every form of human endeavor and will contribute substantially to scientific achievement in all fields."

Dan Noble

(Advertisement)

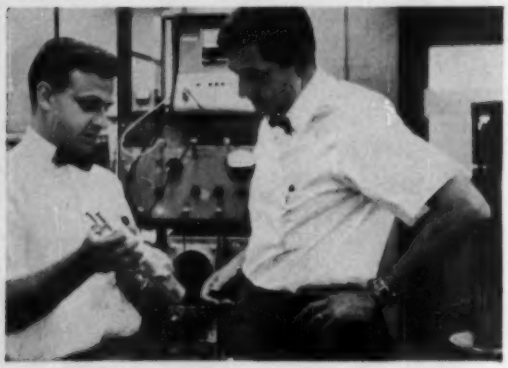
PLEASE TURN PAGE



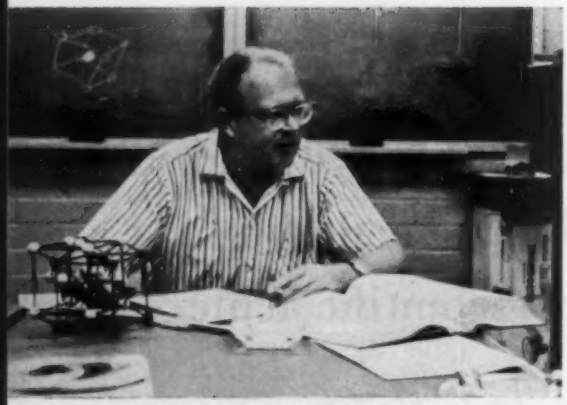
Ferrimagnetic principles are demonstrated by scientist in charge of Motorola's Solid State program, Dr. H. William Welch, Jr., director of research and development, Military Electronics Division. Dr. Welch as a University of Michigan professor established that school's Solid State laboratory and introduced new curricula in Solid State devices and their applications. He holds an I.R.E. Fellow Award for contributions to development of solid state devices and microwave tubes.

Typical of solid state materials now being offered for sale by Motorola are these ferrite rods and bars being examined by Donald L. Fresh, manager of the Solid State Materials Laboratory.

John C. Cacheris, right, manager of the Microwave Applications Laboratory, and a member of his staff inspect a parametric amplifier, one of several devices now being produced by Motorola's Solid State Dept.



Imaginative leadership plus the most modern of laboratory facilities have helped foster a creative environment that is attracting top talent to Motorola. Here, Dr. Arthur L. Aden, associate director of research and development for Motorola's Military Electronics Division, shows a new member of his staff equipment for photographing printed circuits. Dr. Aden welcomes inquiries from qualified engineers and physicists who would like to join his department.



James R. Black, manager of Motorola Microelectronics Laboratory, heads work which leads toward the mass production of economical microelectronic components so small that several would fit on the period that ends this sentence.

How Solid State Electronics is shaping the future

MILITARY ELECTRONICS—industry as well—is being radically changed by rapid advances in solid state technology. Predicted for the near future are computers small enough to fit in the palm of a hand, receivers that will detect the weakest signals from distant satellites.

Motorola's highly experienced Solid State Department, in close cooperation with the Semiconductor Products Division, is advancing the state of the art on several fronts, one of the most promising of which is microelectronics.

By making use of crystalline functional circuit elements created in volume quantities by surface etching or film deposition methods, Motorola researchers anticipate they will soon be able to design equipment with component densities of tens of millions per cubic foot.

This high density will result in a great reduction in systems and computer size coupled with a significant increase in reliability, and it will lead to the development of self organizing computers for such complex tasks as the solution of military logistics problems and space guidance.

In microelectronics and in other areas, Motorola scientists, including those of the Semiconductor Division, are investigating the ferroelectrical, ferrimagnetic, piezoelectrical and pyroelectrical characteristics of monocrystalline and polycrystalline solids. New materials possessing these useful characteristics are created and produced in the Materials Laboratory. Typical applications: newly developed ferroelectrical or piezoelectrical materials to be used in transducers for submarine detection.

At present, the Applications Laboratory is making extensive use of ferrites and semiconductors in the development of broad lines of isolators, circulators and parametric amplifiers. The latter device has already demonstrated its worth in satellite-tracking radars, IGY research receivers, uhf television receivers and radio. In the study and design stage are new and advanced ferrimagnetic devices such as microwave switches, ferrimagnetic limiters and semiconductor switches.

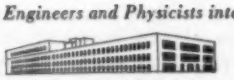
Still another research frontier where striking preliminary results have been achieved is a low-voltage facsimile paper for the transmission of teletype and other information. Applications in the fields of combat surveillance, logistics control and other important military programs are foreseen.

Military Electronics Division's expanding capability in solid state electronics is described in a new booklet entitled: "Solid State Frontiers at Motorola." *Request your copy from Technical Data Service, Motorola, Inc., Military Electronics Division, 8201 East McDowell Road, Scottsdale, Arizona.*

MOTOROLA

Military Electronics Division / CHICAGO • PHOENIX • RIVERSIDE

Engineers and Physicists interested in career opportunities are invited to write: Motorola, Inc., Military Electronics Division



1450 NORTH CICERO AVENUE
CHICAGO 51, ILLINOIS

8201 EAST McDOWELL ROAD
SCOTTSDALE, ARIZONA

8330 INDIANA AVENUE
RIVERSIDE, CALIFORNIA

4-27-6

VĀP-AIR'S YEARS OF EXPERIENCE CAN SAVE YOU HUNDREDS OF SPECIALIZED MAN-HOURS in solving critical thermal control problems

a case in point:

sophisticated problem:

AIR TEMP CONTROL IN MACH 2 MANNED CRAFT

Needed:
absolute accuracy under severe G conditions, light weight, safety in case of electrical failure, sensitivity throughout a wide ambient temperature spectrum, low initial cost, simple maintenance, interchangeable parts for 3 complete air temp systems:

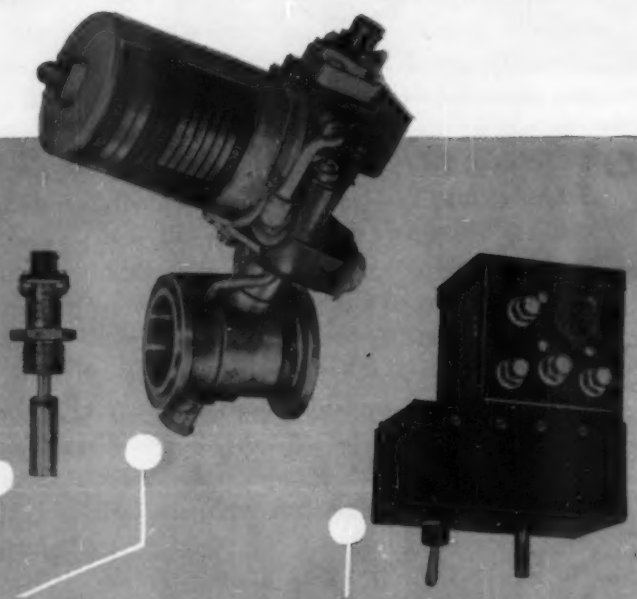
cabin temperature
pressure suit
electronic compartment

NAVY A3J Vigilante
Mach 2 aircraft

simple solution

VĀP-AIR ELECTRO-PNEUMATIC CONTROL SYSTEM

The 3 basic components shown at right, interconnected by VĀP-AIR designed electrical circuits met all these requirements...with response rates full open to full close of less than three seconds. Because all pick-ups and valves have the same resistance value, several systems for one craft can use the same parts!



DUCT TEMPERATURE SENSOR
One of many types made by Vapor, including thermistors, wire-wound resistance-temperature pick-ups, mercury contact thermostats, or the new MERCISTOR.

VALVE AND ACTUATOR
Two types: ON-OFF; or full-modulating, variable opening. Considerably lighter and smaller than electric valves, lighter than other pneumatic valves. Provides accurate hot and cold air proportioning. Other coaxial designs available for minimum envelope and rugged light weight.

CONTROLLER
Automatic or manual precision Magnetic Amplifier Power Controller acts as temperature controller, power converter, and transformer. Safe, simple, rugged, reliable!

CALL ON VĀP-AIR FOR SYSTEMS ENGINEERING AID WHENEVER A TEMPERATURE CONTROL PROBLEM ARISES:

AIR TEMPERATURE: Instrument & electronic compartments, cabins, cockpits, windshield and wing anti-ice.

LIQUID TEMPERATURE: All liquids, including fuel systems, batteries, exotic rocket fuels, H_2O_2, acids.

SURFACE TEMPERATURE: Anti-icing, de-icing, nacelles, primary heat exchangers, generators, alternators, canopies, bearings, gyroscopes, accelerometers.

Detailed data and problem analysis for those who design for flight. Write on your letterhead, specify type of equipment or nature of problem.

VĀP-AIR
The Aeronautical Division of
VAPOR HEATING CORPORATION
80 E. Jackson Blvd., Chicago 4, Ill. Dept. 25-G.
Vapor Heating (Canada) Limited
3955 Courtrai Ave., Montreal 26, Quebec

ing equipment and operational methods and will ultimately assist the government in expanding System 433L into a national weather service.

Although USAF administers the contract, 433L is jointly sponsored by the Federal Aviation Agency and is intended for joint use by civil and military operators. The program is directed by the 433L Electronic System Supporting Project Office at Waltham, Mass., a group headed by Col. George Guy. Col. Guy has been involved in the weather program for several years, and his group has now brought it to the point where systems integration can be started.

System 433L is a major step in a general effort to improve the whole process of weather observing, reporting and forecasting. Last year, Bendix Aviation Corp. won a contract for development of the 460L airborne weather reconnaissance system, and System 433L must be compatible with 460L, as well as with the 480L USAF global reconnaissance system and other systems. It must also be compatible with present weather systems so that it can be phased in on a national scale in an orderly manner.

Business Potential

There has always been a serious need for improvement in weather observing and forecasting techniques, but this need has become more compelling with the development of high-speed turbine powered aircraft, the advent of aerial refueling, the growth of large scale missile operations and the possibilities emerging from meteorological satellite work. Radioactive fallout is another area where fast, accurate weather data is imperative. Along with these applications, a wide scale of commercial benefits in agriculture and other areas is expected as an eventual byproduct of an efficient, integrated weather service.

A number of aircraft and electronics companies have recognized a growing and quite significant business potential in the weather system field and have been eager to get an early start. Evidence of this interest can be seen in the fact that the USAF source selection board picked United Aircraft after screening proposals from 13 companies.

In developing the 433L system, UAC will be relying heavily on the data processing capability its Research Department built up here through the use of large digital computers. Along with its own capabilities, the company will rely on its seven team associates, which will be subcontractors on the project. Their role will be to review developments in their assigned areas and to determine requirements. They will evaluate equipment already developed and determine its compatibility with the over-all system.

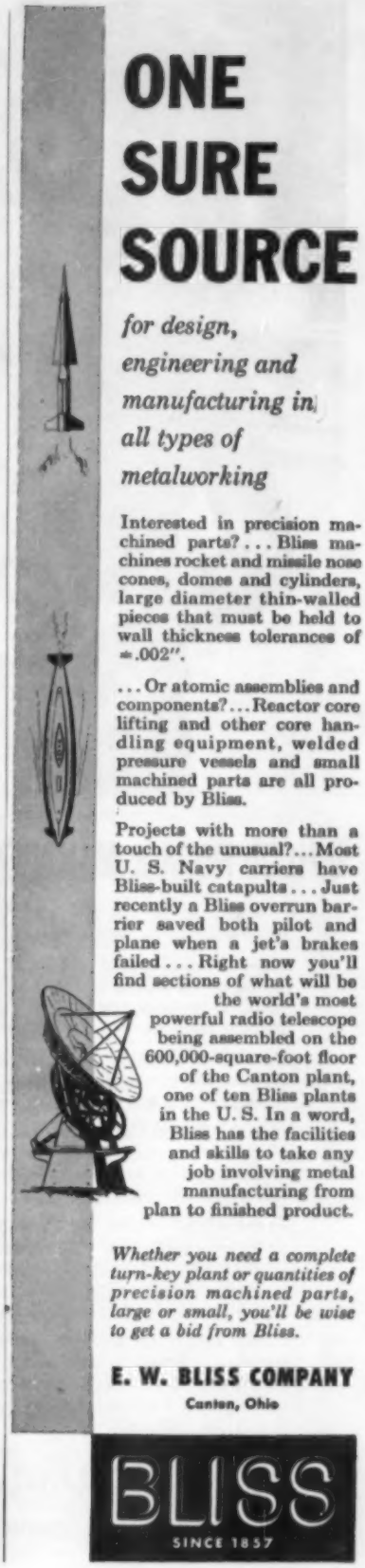
Among the team partners, Dunlap and Associates will work on human engineering and human factors problems, Hermes Electronics (formerly Hycon Eastern) will do studies in the data handling and communications area and Philco Corp. will handle display and presentation problems. Technical Operations, Inc., will do systems analysis and work in the simulation area, and weather observing problems are the responsibility of Tele-Dynamics, Inc.

A UAC neighbor here, the Travelers Weather Research Center of the Travelers Insurance Co., will handle the weather forecasting field, and Western Union Telegraph Co. will do communications and data handling work. UAC will call on its own Pratt & Whitney Aircraft Service School for training functions.

System 433L program is a new kind of job for United Aircraft in a couple of ways. It is the company's first entry into the weather field, and it is also the first systems management contract of this size UAC has had. A measure of the importance attached to the project can be seen in the fact that Program Manager Richard Molloy reports directly to UAC Vice President-Engineering W. A. Parkins, and through Parkins, directly to top management.

System 433L doesn't fit the fields of any of the four UAC operating divi-

Performance
proved in flight
You can get up to a 10% increase in propeller efficiency by selecting the new Sensenich . . .
FIXED PITCH METAL
CAA approved up to 165 hp
Also available from Sensenich . . .
FIXED PITCH WOOD
CAA approved up to 225 hp
TEST CLUBS up to 3000 hp
See your nearest Sensenich distributor or dealer or contact the plant.
Dept. W, Sensenich Corp., Lancaster, Pa.
Sensenich PROP SHOP . . . Certified Repair Station for all makes fixed pitch metal or wood propellers . . . Sensenich, Beech, Hartzell and McCauley controllables. Magnaflux, etching, anodizing and plating service available. Service Hanger on Lancaster Municipal Airport. Approved Propeller Repair Station 3528, Unlimited Class 1 and 2 ratings. Distributor of Hartzell propellers and parts.
SENSENICH
Sensenich Propellers
SERVING THE AIRCRAFT INDUSTRY FOR MORE THAN 25 YEARS


ONE SURE SOURCE
for design, engineering and manufacturing in all types of metalworking
Interested in precision machined parts? . . . Bliss machines rocket and missile nose cones, domes and cylinders, large diameter thin-walled pieces that must be held to wall thickness tolerances of ±.002".
. . . Or atomic assemblies and components? . . . Reactor core lifting and other core handling equipment, welded pressure vessels and small machined parts are all produced by Bliss.
Projects with more than a touch of the unusual? . . . Most U. S. Navy carriers have Bliss-built catapults . . . Just recently a Bliss overrun barrier saved both pilot and plane when a jet's brakes failed . . . Right now you'll find sections of what will be the world's most powerful radio telescope being assembled on the 600,000-square-foot floor of the Canton plant, one of ten Bliss plants in the U. S. In a word, Bliss has the facilities and skills to take any job involving metal manufacturing from plan to finished product.
Whether you need a complete turn-key plant or quantities of precision machined parts, large or small, you'll be wise to get a bid from Bliss.
E. W. BLISS COMPANY
Canton, Ohio
BLISS
SINCE 1857

...NEWS IS HAPPENING AT NORTHROP

Now in production – the world's first space-age trainer – USAF T-38 Talon. Mission: to train tomorrow's airmen in the art of supersonic flight.

UNIQUE NORAIR MANAGEMENT METHODS CUTTING SPACE-AGE AIRCRAFT COST !

T-38 Talon is the first of Northrop's new family of high-performance, low-cost aircraft produced at Norair, Hawthorne, California. Using an inherently economical design as a base, Norair management is reducing costs even further by applying three Norair-created methods.

Pace – Performance And Cost Evaluation – is Norair's new way to measure group effectiveness. Its successful application to the T-38 program has created wide military and civilian interest.

Norair's Target Cost Control constantly monitors all areas of cost – from preliminary design to final assembly. Such a continuing control system keeps production costs at a minimum, assures maximum efficiency.

Years-Ahead Production Techniques utilize Norair's 20 years of airframe experience. In the area of honeycomb structures – for example–Norair-designed high-accuracy forming, contour milling, and adhesive bonding techniques trim T-38 costs – producing higher-quality hardware for less money.

Norair combines these and other management methods with its completely integrated research and development facilities. Result: earlier and more effective answers to the problems of free-world defense in the space age – at minimum cost.

NORAIR *formerly Northrop Division*
HAWTHORNE, CALIFORNIA
A Division of **NORTHROP CORPORATION**

sions or of the Missiles and Space Systems Division, although the Missiles and Space Systems Division is interested in the meteorological satellite area, so the program is set up as a separate entity. This arrangement is functionally more practical, but it also will allow top management to keep a close watch and provide quick response where necessary as the program proceeds.

Under the 433L contract, which is now under negotiation, integration of equipment and techniques is the main task of the UAC team. No scientific or technical breakthroughs are considered necessary, but only the effort to organize a system and put present knowledge to work. Parkins points out that getting the program started is an important step in itself, since "a job started is a job half done."

The aim of the 433L program is to combine modern observing, data processing, analytical, transmission and display techniques into a system which will cut the time lapse between observation and report. It is expected to reduce the six hours it may now take between time of observation and the time a forecast is ready to something on the order of 20 min. A number of new techniques, like automatic observation equipment and high-speed transmission, will be used, but the system is also to use manual techniques and other less costly approaches wherever feasible to keep costs down.

Test Facility

First physical evidence of System 433L will be the test facility UAC will build along the Atlantic Coast and which is scheduled for operation in November, 1960. The nine stations in the network proposed by UAC will be equipped to make weather observations, transmit the data, receive weather information and display it. They will be linked with each other and with a central data processing center.

Each of the nine stations has a special character which makes it important in the 433L test system. Hanscom Field is the site of AFCRC, and Westover AFB is a Strategic Air Command operations base and a SAC forecasting center. Suffolk County AFB is an Air Defense Command base and is also used for FAA testing.

New York International Airport is a major airline terminal and a Weather Bureau operating base, and Teterboro Airport is a commercial facility largely used by business and private aircraft. McGuire AFB is a Military Air Transport Service base, an ADC base and has a SAGE center. Atlantic City is the site of the FAA technical development center.

To the south, Washington National Airport is an airline terminal and is close to major Weather Bureau activi-

A TYPICAL BEKEY CUSTOM MOTOR DESIGN PROJECT

BEKEY Custom 120-pole hyspersyn® motor drives new Genisco precision centrifuge

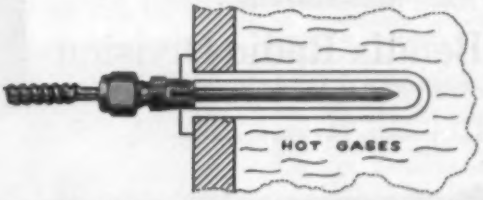
To attain desired accuracies, angular velocity of the Genisco A931 Centrifuge must be constant to 1 part in 50,000. To get this constancy, Genisco uses a Bekey 120-pole, three phase, *hysteresis* motor with induction start and *permanent* magnet excitation for *synchronous* operation.

Bekey specializes in highly efficient, custom rotating equipment. Motors and generators can be designed to operate on any frequency, voltage or speed; in any ambient; and can be built in any shape. No requirement too specialized or small. Custom *Hyspersyn* motors, 75% to 90% efficient, can be delivered in 60 days with *no charge for tooling!* Inquire today!

BEKEY CUSTOM MOTORS
Bekey Division
Genisco, Inc.
2233 Federal Avenue
Los Angeles 64, Calif.

Thermocouple Life Increased Up To 135 Times

With T-E's *Ceramo*® Construction



For measuring all types of process temperatures, T-E's "Ceramo" construction—ceramic insulation, metal sheathing—provides a tremendous increase in thermocouple life over conventional, open-end types. In a typical application, enclosed hot junction, ⅛" O.D. "Ceramo" thermocouples were used recently in a hydro carbon cracking unit operating continuously at 1616° F. "Ceramo" thermocouples lasted 7 to 9 months—*while 14 gage bare wire thermocouples lasted but 2 to 14 days.* And there was no significant difference in response. "Ceramo" thermocouples are available in all standard calibrations. Overall diameters—1/25" to 7/16".

Write for Bulletin 325-C

Thermo Electric Co. Inc.
SADDLE BROOK, NEW JERSEY
In Canada—THERMO ELECTRIC (Canada) Ltd., Brampton, Ont.

NEW MANUAL* VOR NAV UNIT ADDED TO BENDIX LINE

Complete line of avionics equipment meets COMM/NAV needs all the way from a light-twin to a DC-8

The new Bendix MNA-21A Navigation Unit now makes available to the aviation industry exceptionally high caliber *manual VOR/LOC operation*, at a very low cost in weight and size. No AC power is required. Designed to be used in conjunction with the popular RA-21A VHF COMM/NAV Receiver, this new unit affords the *same* high accuracy and dependability available in other Bendix avionics equipment.

With this latest addition to its line of COMM/-NAV systems, Bendix now offers you the best answer to your most exacting needs, whether you are outfitting a light-twin or a DC-8.

The TA-21A VHF Transmitter provides 25 watts r-f output on 360 crystal-controlled channels. The RA-21A VHF Receiver provides reception on 360 crystal-controlled communication channels plus 200 additional navigation channels.

*Operates standard FPDI, without RMI capability.

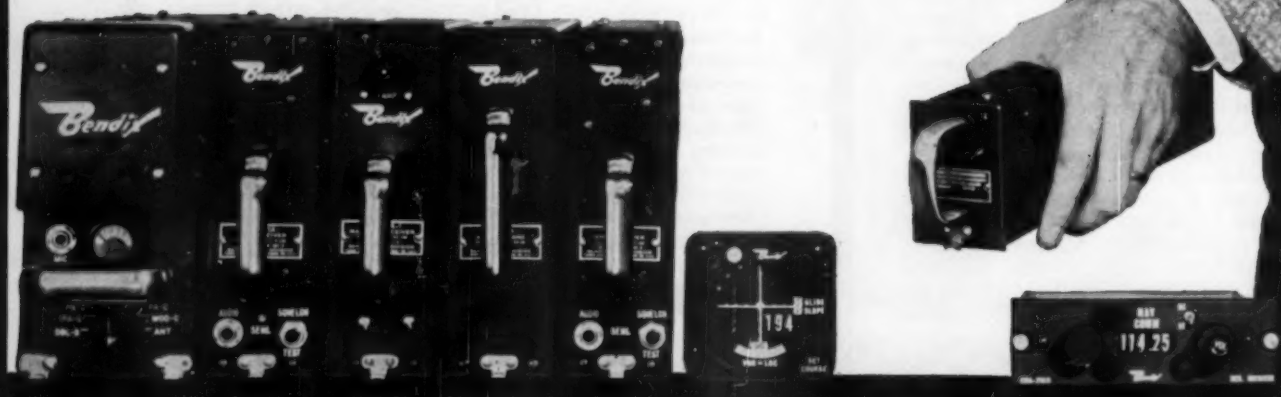
For further information, write—

Bendix Radio Division

AVIONICS GROUP • BALTIMORE 4, MARYLAND

Export Sales & Service:
Bendix International, 205 E. 42nd St., New York 17, N.Y.

Bendix
AVIATION CORPORATION



ties. Oceana Naval Air Station is a base for Navy operations. Any change in this proposed network will probably mean inclusion of a more westerly station, since weather generally moves in from the west.

Also included in the Test Facility will be the National Meteorological Center with the Joint Numerical Weather Prediction Unit. This organization is somewhat similar to the system envisioned in System 433L in that it receives weather data from various national and international sources and prepares forecasts. The test facility will be exchanging information with NMC.

Core of the test facility is the data processing center, and UAC has proposed that this center be located here because it is a central point on the test network, it is close to the ESSPO and it is close to the Travelers installation.

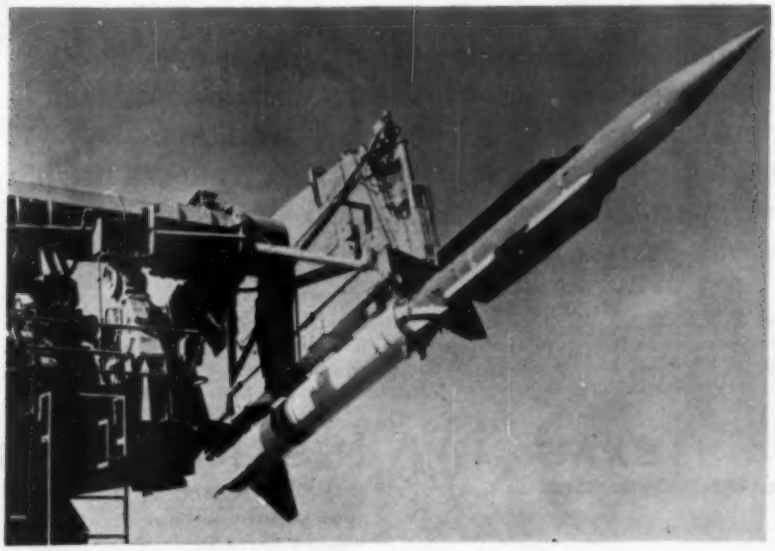
United Aircraft also favors the East Hartford location because it would be easy to expand the company's considerable computer facility to take on the workload. UAC Research Department has three IBM 704 systems at work now and has two Philco TRANSAC S-2000 solid state computers on order for delivery in January and October next year. These two computers will gradually replace the three IBM 704 systems over the next few years.

UAC has recommended the Philco TRANSAC for use in the 433L program, arguing that it meets all the requirements of the 433L system and pointing out that the TRANSAC to be delivered here in January could be diverted to 433L use as the need for it develops.

Program Manager Molloy points out that United Aircraft's work with digital computers will be valuable in the development of a data processing center for the 433L network. UAC has had considerable experience in developing accessory equipment to tailor the 704 to specific tests and make it work at these

Navy Tests Advanced Version of Terrier

Advanced Convair Terrier guided anti-aircraft missile is launched (above) in a test firing at Naval Ordnance Test Station, China Lake, Calif. Major external change is different fin configuration on second stage (below). Weapon is in production (AW July 13, p. 35).



CABLE and WIRE LEADS

by HOWARD E. PENDERGAST
Technical Director Rex Corporation

Factors that influence choice of conductors

Resistance, cost, weight, tensile strength and solderability are important considerations in selecting the best conductor for an application.

Resistance is perhaps the most vital factor. The primary function of a conductor is to carry electrical energy with minimum loss. The resistance of the conductor and its insulating medium influence the degree of potential drop. Resistance is a function of temperature. Typical values for conductors at room temperature are shown below:

Material	Resistivity
Copper	1.72×10^{-6} ohm cm
Aluminum	2.82×10^{-6} ohm cm
Silver	1.62×10^{-6} ohm cm

Cost is chiefly a function of the metal used. Silver would be the obvious choice but for its expense. Copper usually combines the best cost-resistivity ratio.

Weight. Where weight is extremely important and lower conductivity is acceptable, aluminum can be considered. It is preferred for high power transmission lines, for example.

Tensile Strength — "cladding" techniques permit the combination of two metals — one for strength, the other for conductivity. Thus, copper clad steel is now popular for applications calling for high tensile strength.

Solderability is of critical importance for permanent connections. Tin coating by electro-deposition or dipping before final sizing and stranding of conductors is now universal. A growing demand for tin overcoated stranded conductors is prevalent. This offers reduced labor costs during assembly but substantially lowers flexing life and flexibility of the basic stranded conductor. Silver plating is now common with increased demand for high temperature wire. Because manufacturing temperatures are higher than the melting point of tin, silver has been selected as an aid to soldering and a protection for copper. Various alloys of nickel both as plating and cladding are under study as replacements for silver plating. Nickel's high melting point and lack of wicking promise to reduce soldering failures with high temperature wires.

Technical Data on insulated wires and cables, standard or special, for commercial and military applications is yours for the asking. Write:

THE REX CORPORATION
A Subsidiary of American Enka Corporation
WEST ACTON, MASS. — COlonial 3-7721
Insulated Wire & Cable · Mil-spec Wire

T/I missile
guidance and telemetry

BEEPS WITH A HIGH IQ

...for missile sensing, guiding and telemetering

Electronic signals that report the truth, the whole truth, and nothing but . . . wring the best performance from missile systems. By pushing beyond known capabilities in sensitivity and accuracy, Texas Instruments is producing "high IQ" systems and equipments for a dozen guided vehicles used in every basic mission: air-to-air, air-to-surface, surface-to-air, surface-to-surface — IRBM and ICBM—plus drone sensors and satellite instrumentation. ⬬ TI exceeds tough specs against tight deadlines, regularly . . . specs asking solutions to problems never posed before. For detailed discussion, cleared personnel please write or call: SERVICE ENGINEERING DEPARTMENT.

RESEARCH/DESIGN/DEVELOPMENT/MANUFACTURING of systems for: *Air traffic control • Airborne early warning • Antimissile • Antisubmarine warfare • Attack control • Countermeasures • Missile systems Navigation • Reconnaissance • Space electronics; and on detector cells, engine instruments, infrared, intercom, microwave, optics, radar, sonar, telemetry, time standards, timers, transformers and other precision devices.*

APPARATUS DIVISION

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE
DALLAS 9, TEXAS

tasks more efficiently. Company also has experience in processing data from remote locations, since the computers are linked with UAC divisions here, in Stratford, Conn., and West Palm Beach, Fla., and with a wind tunnel complex.

Right now, it is important to get the test facility in operation as quickly as possible, Molloy told AVIATION WEEK, in order to try various pieces of equipment and techniques and find out how they work and what the problems are. Program will explore such areas as the problem of interpreting radar information and the design of displays to meet the needs of the various users of weather information. Hardware in the program will be government furnished equipment now under development, but some of it may be discarded and new equipment may be added as this highly experimental program progresses.

With the establishment and operation of the test facility, the UAC team's hardware role in 433L is ended under the concepts in the contract now under negotiation. After that, UAC will use its test experience and evaluations to help the government prepare detailed specifications and other data needed to expand 433L into a national weather service and extend it on a global basis.

The system which eventually evolves from the 433L program will have to be made up of elements which blend with a number of present and future systems, so compatibility is a key feaure. The 433L system will advance the current weather system, but it must work well with the old system until the old system is replaced. It must also integrate with SAC and SAGE operations, as well as with inputs from the 460L and 480L systems which will be coming along.

AMC Contracts

Wright-Patterson AFB—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

Military Products Division, International Business Machines Corp., Owego, N. Y., components for the AN/ASB-9 bombing navigation system used on B-52G aircraft, (PR EG-9-1280-4675), $3 million.

Convair Division, General Dynamics Corp., San Diego, Calif., 7 ea., instrument systems trainers; 6 ea., speed brake and drag chute trainers for F-102 MTU, (PR's PH-7-28-7420 and PH-7-28-7530), $221,794.

Mincom Division, Minnesota Mining and Manufacturing Co., Los Angeles, Calif., 5 ea., recorder/reproducers, Mincom model C-114, (PR 913152-A), $139,840.

North American Aviation, Inc., Los Angeles, Calif., design, development, fabrication and test of all-mechanical aileron control system (for use in high performance aircraft), (PR EG-9-R&D-4474), $600,000.

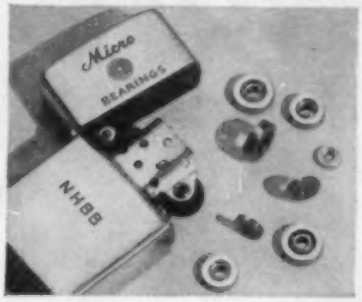
Graflex, Inc., Rochester, N. Y., 231 ea., Speed Graphic camera sets, S/N 6720-543-2413-J360, end use: ground support equipment, (MIPR R59-524/383-NSF and amendment No. 1), $81,971.

Aircraft Division, McCauley Industrial Corp., Dayton, Ohio, 227 ea., propeller assemblies, fixed pitch, P/N 4019-1A-200-FM-9047 end use: spares for L-19A aircraft, (MIPR R59-4417-TCSMC-A), $37,650.

BEARING ABSTRACTS

by **A. N. DANIELS**, *President*
New Hampshire Ball Bearings

NEW NHBB BEARINGS FEATURE NARROWER WIDTHS



There's a new, lean look in miniature ball bearings these days. It was brought about by the demands of designers of small synchros, servos, motors, potentiometers and gear trains. They said that standard shielded miniature bearings were much too "fat". They asked for "skinny" bearings that would allow them to increase the width, strength or capacity of working components.

Back in 1955, New Hampshire Ball Bearings, Inc., introduced its UP line (U for thin, P for single shield). These bearings satisfied a good many designers. These special shielded bearings have the same width as standard unshielded bearings of the same O.D. and bore. But some designers still insisted on thinner bearings.

In 1958, they got what they asked for. A new series of thin bearings, called NHBB Wafers was introduced. These light bearings offer the advantages of widths as much as 40% narrower than standard unshielded bearings of the same O.D. and bore, as illustrated in *Fig. 2*.

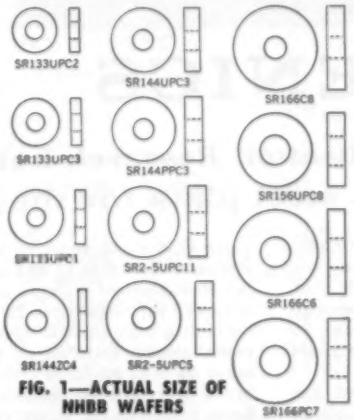


FIG. 1—ACTUAL SIZE OF NHBB WAFERS

The space-saving feature of these new NHBB wafer bearings has been welcomed particularly by designers of small servos, synchros and motors. It permits miniaturization to be carried a step farther when smaller packages are required. In other cases, the narrower bearing widths allow the addition of more iron or copper to rotors and stators without changing package size. This means that greater capacity and improved performance can be built into existing designs.

TWELVE NEW NUMBERS

NHBB Wafer bearings are now available in twelve numbers: seven with single shields, one with two shields and four unshielded, as charted below.

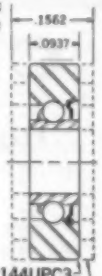
NUMBER	BORE	O.D.	WIDTH
SR133UPC2	.0937	.2500	.0625
SR133UPC3	.0937	.2750	.0625
SR133UPC1	.0937	.3125	.0625
SR144ZC4*	.1250	.3750	.047
SR144UPC3	.1250	.3750	.0937
SR144PPC3**	.1250	.3750	.1094
SR2-5UPC11	.1250	.4250	.1094
SR2-5UPC5	.1250	.4375	.1094
SR166C8	.1250	.5000	.1094
SR156UPC8	.1875	.4375	.1094
SR166C6	.1875	.5000	.1094
SR166PC7	.1875	.5000	.1250

*Unshielded, spring separators
**Two shields

SPECIFICATIONS

Starting Torque: Standard starting torque is 1400 mg mm under 75 gm thrust, 90% guaranteed at 1100 mg mm if specified. Lower levels by selection.
Material: 440 C stainless steel.
Tolerances: ABEC7 or better.
Radial Play and Lubrication: as specified by customer.

Complete specifications are contained in one design handbook.



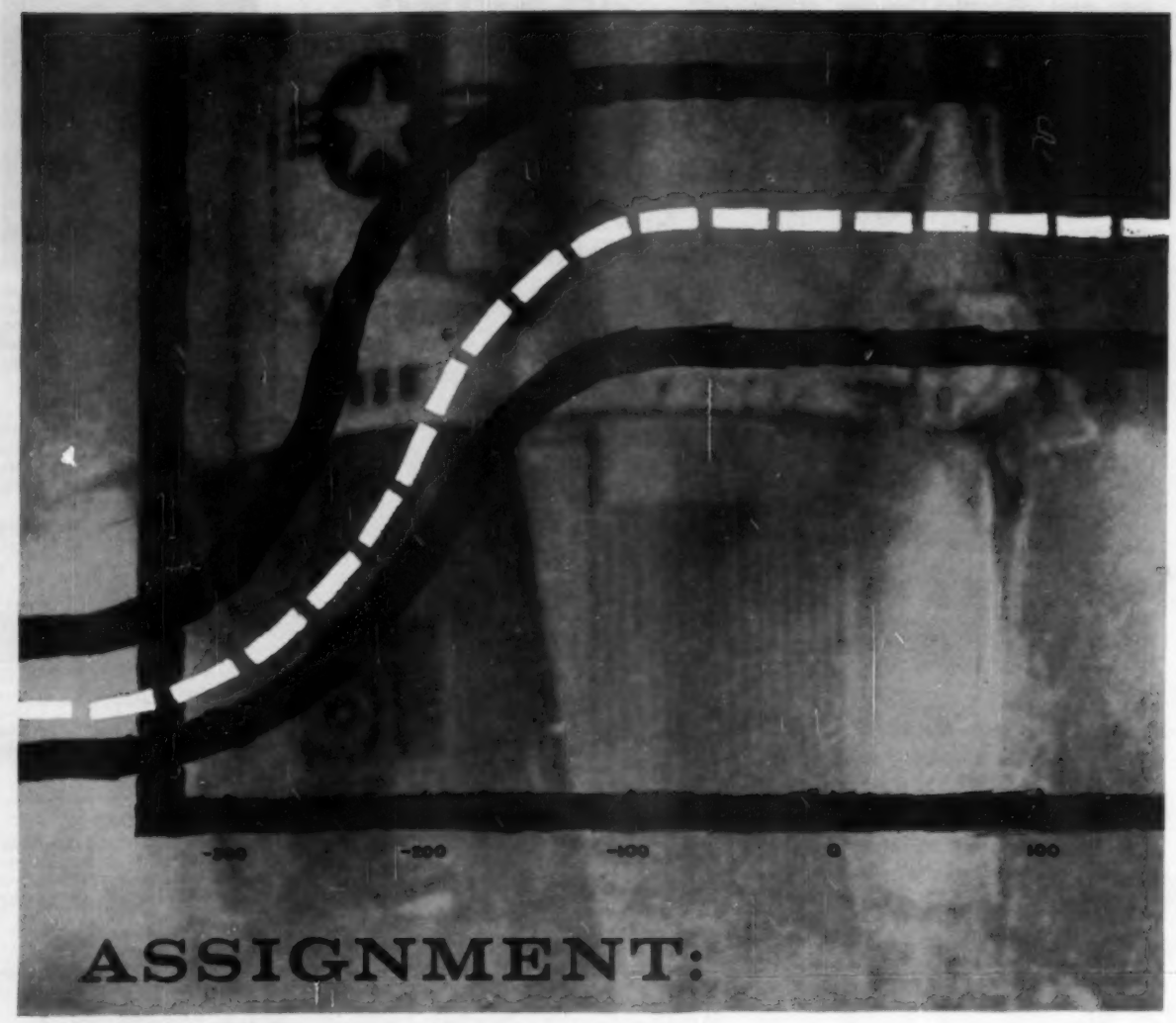
COMPARISON OF WAFER SR144UPC3 WITH STANDARD BEARING SR2

FIG. 2

DESIGNERS HANDBOOK FREE TO ENGINEERS

If you work with miniature ball bearings, you'll find this 80-page authoritative handbook a great help in solving problems in designing instruments or electro-mechanical assemblies. It will be sent free to qualified engineers, draftsmen and purchasing agents. Write:

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH, N. H.



CRYOGENICS

How Lukens *Application Research* helps you find the right steel plate for the job

If your assignment is designing equipment for extreme low temperature service—our Application Engineering staff can help you. They research problems of every description from the design stage right through to how the equipment has performed for years after its installation.

Missile components and liquefied gas tanks would be dangerously susceptible to cracking if made from ordinary steel. Seeking economical metals for such applications, Lukens engineers began years ago to watch the performance of nickel bearing alloys in a variety of low temperature equipment. Result: a broad understanding of metal behavior at various low temperature levels.

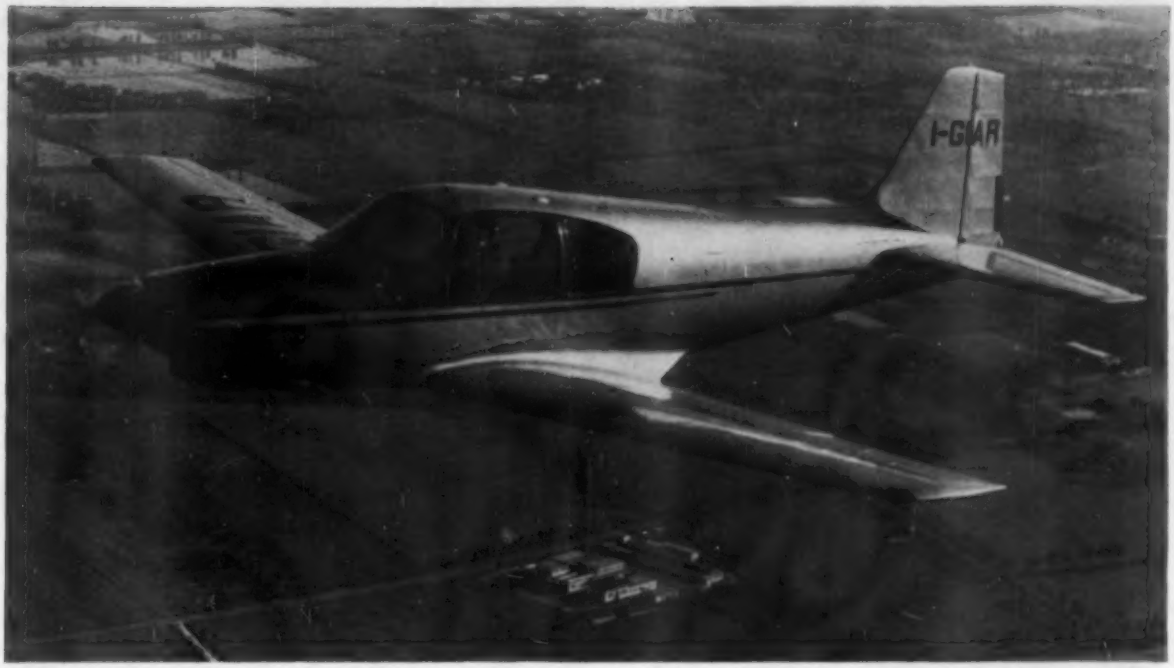
Examples: In the storage of liquefied oxygen, a tank of *Nine Nickel steel* provided more than eight years of trouble-free performance. Suitable to minus 320°F. service the steel showed no signs of cracking when removed for inspection. In frigid chambers for testing high altitude aircraft, *2½ percent nickel steel* is standing up well under pressures as high as 7,000,000 pounds. And in arctic locomotives operating at temperatures to minus 50°F. on rugged mountain roadbeds, main structures of *Lukens "T-1" Steel* have required no maintenance whatsoever.

Lukens Application Engineers know these cases . . . plus many more. *If your assignment is cryogenics, why not let it be our assignment, too?* Contact Manager, Application Engineering, J79 Services Building, Lukens Steel Company, Coatesville, Pa.

ASK FOR LUKENS NINE NICKEL STEEL BULLETIN

Helping Industry Choose Steels That Fit The Job

LUKENS



ALL-WOOD Nibbio F-14 costs $16,800 with standard equipment. With 24-channel VHF and radio compass the price would be about $20,000. Laminar profile wing has a 4-deg. negative twisting between joint and tips to aid lateral control and counteract spin tendency.

Aviation Week Pilot Report:

All-Wood Nibbio Is Fast, Maneuverable

By Robert I. Stanfield

Paris—Aviamilano's all-wood, four-place Nibbio F.14 is a fast, highly maneuverable sport-executive airplane which the Milan, Italy, manufacturer expects to have certificated in the United States this September.

The Nibbio has a normal operating range of about 800 mi. Empty weight, with standard equipment, is 1,500 lb. Maximum gross is 2,550 lb. Wing span is but 31.2 ft.; wing area is 128 sq. ft. Average speed, during AVIATION WEEK evaluation at the Paris air show, was 190 mph. indicated.

Powerplant for the F.14 is a Lycoming O360-A1A four-cylinder, direct-drive, horizontally opposed, air-cooled engine developing 180 hp. at 2,700 rpm. at sea level. Compression ratio is 8.5 to 1. Piston displacement is 361 cu. in. Dry weight of the engine, with equipment, is 290 lb. Fuel grade is 91/96 octane. Propeller is Hartzell, all-metal, constant speed.

Current cost of the Nibbio, with standard equipment, is $16,800. With 24-channel VHF and radio compass, the price, AVIATION WEEK was told,

Nibbio F.14

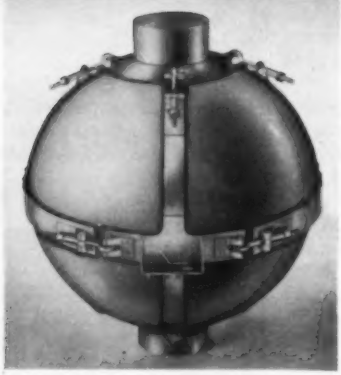
SPECIFICATIONS	
Wing span	31.2 ft.
Length	23.6 ft.
Height	8.1 ft.
Wing area	128 sq. ft.
Maximum gross weight	2,550 lb.
Empty weight (standard)	1,500 lb.
Useful load (including optional equip.)	1,050 lb.
Wing loading	18.4 lb./sq. ft.
Power loading	14.15 lb./hp.
Cabin dimensions:	
Length	7.5 ft.
Width	3.6 ft.
Max. height	3.9 ft.
Luggage compartment	1.6 x 3 x 1.6 ft.
Fuel (usable, 91/96 octane)	55 gal.
Oil (1.5 gal.); usable	1 gal.
Engine: Lycoming O360-A1A four-cylinder, horizontally opposed, air cooled, developing 180 hp. at 2,700 rpm. at sea level.	
Propeller: Hartzell, HC-92 ZK-8D metal, constant speed, hydraulic.	

PERFORMANCE*	
Takeoff distance, at 66 mph	590 ft.
Landing distance, at 59 mph	490 ft.
Service ceiling	17,700 ft.
Rate of climb (2,700 rpm.) at 109 mph.	1,200 fpm.
Power-off stall, clean	59 mph.
Power-off stall, gear-flaps lowered	55 mph.
Power-on stall, clean	55 mph.
Power-on, stall, gear-flaps lowered	51 mph.
Max. speed (28.5 in. and 2,700 rpm.)	205 mph.
Never exceed speed (Vne)	250 mph.
Cruising speed (2,450 rpm.)	192 mph.
Normal operating speed (2,350 rpm.)	189 mph.
Economical cruise (at 5,000 ft.)	168 mph.
Range at operating speed	800 mi.
Gear extension	124 mph.
Flap extension	112 mph.
Normal approach speed	93 mph.

* Data corrected to standard atmosphere. aircraft at maximum gross weight of 2,500 lb.

the time has come for

Turbo Products Division: Produced deep drawn, hollow turbine blades and nozzle vanes for this current turbo jet engine. Turbo operation includes design, development, and exclusive tough alloy manufacturing process for gas turbine, missile, and rocket power plant components.



Awica Division: Awica clamps and couplings in complete range of shapes and sizes for a variety of uses provide positive fastening for fluid and electronic systems. Patented Hook-Bolt design is a superior feature of Awica clamps.

U.S. Propellers, Inc.: Produced contra-rotating ducted propellers for this Hiller machine. U.S. Propellers designs and manufactures fixed and constant speed propellers, ducted fans, helicopter blades, wind tunnel and air movement systems.

POLY INDUSTRIES, INC.

a new approach

POLY INDUSTRIES

formerly Turbo Products

AMERICA'S NEWEST COMBINATION OF EXPERIENCED INDUSTRIES

Poly Industries has been created to serve the exacting needs of man's conquest in space. Engineering, design and production authorities, long experienced in the development and manufacture of fluid dynamic and power components and ground support equipment, are here combined in Poly Industries to offer a new range of products and services.

In this new approach six experienced divisions and wholly-owned subsidiaries are highly integrated for close coordination to provide a superior flexibility in supplying specialized knowledge and techniques. High unit production is retained without the loss of individual contract follow-through so important in creative design-engineering, research and development. This exciting new combination of men and facilities simplifies the complex buying function through the single specialized Poly Industries national field sales staff. We invite your inquiry.

Write for new Facilities Brochure.

Fabricel Division has facilities for forming and contouring all types of aluminum and fiberglass honeycomb assemblies, metal fabrication and ground support equipment. Shown is target rocket and typical ground support vehicle.

Lefco Products, Inc.: Full line of standard shapes, plus custom design facilities, illustrates the scope of Lefco in the production of specialized fluorocarbon (Teflon and Kel-F) and other high performance plastic materials.

Ador Corp.: Produces prefabricated metal structures to shelter support personnel and equipment necessary for flight and launching of missiles. Ador facilities include engineering as well as high volume sheet metal production.

Exceptional employment opportunities for engineers experienced in fluid dynamics and power components

12177 Montague Street, Pacoima, California

A unique combination of engineering and scientific skills, coupled with production ability . . . plus more than two decades of continuous development and production of newer and better airborne instruments – over 400,000 reliable guidance controls delivered – these are the reasons why Whittaker Gyro instruments are operational on many of the nation's major missile programs. From a simple gyro to complete stabilizing systems . . . Whittaker can provide the latest in design.

Check These Advantages In The New Whittaker Sub-Miniature Rate Gyro!

- reliable performance from – 65 F to 400 F
- only ¾ inch diameter – 2 inches long
- non floated – eliminates fluid expansion problems
- quick start – no heater necessary

For additional information on the Sub-Miniature Gyro – on any specialized control components or systems . . . write today for technical data.

Floated rate gyros / Directional gyros
Vertical gyros / Spring energized gyros
Auto-pilots / Stable platforms / Rate switches

400,000

REASONS WHY WHITTAKER GYRO IS FIRST IN ADVANCED CAPABILITIES

"A Guide To Better Flight Controls"

WG

WHITTAKER GYRO
DIVISION OF TELECOMPUTING CORPORATION
16217 LINDBERGH ST., VAN NUYS, CALIF. PHONE: TRIANGLE 3-1950

NIBBIO F.14 sits low, facilitating maintenance. Both wooden wing and fuselage are covered with plywood, topped with fabric. Nose wheel is linked to the rudder pedals. Airplane is entered by a wing walk-up on right side. Propeller is Hartzell, all-metal, constant speed.

would approximate $20,000. The Nibbio is an attractive airplane that sits close to the ground. Laminar profile wing, NACA 64000 series, has a 13 deg. ratio at root and 10 deg. at tip. Between joint and tips is a negative twisting of 4 deg. to aid lateral control and counteract spin tendency.

The fuselage is all wood monocoque structure in two sections bolted together. Both wing and fuselage are plywood covered, and the plywood is covered with fabric. Aviamilano is studying the idea of replacing the fabric with an aluminum cover before the airplane is marketed in the United States.

The airplane is entered via wing walk-up on right hand side. With four of us aboard, including Aviamilano test pilot Vico Rosaspina, and about 40 gal. of fuel, the airplane grossed 2,447 lb., close to maximum.

Prototype's Controls

Controls in the prototype demonstrator—No. I-GIAR—are dual. Fuel selector and trim controls sit on a bridge on the floor between the pilots. We sat almost flat, in the front, and head room was not lacking. Rear passengers later stated that they were quite comfortable throughout the flight. Cabin of the Nibbio is 3.6 ft. in width, 7.5 ft. in length and 3.9 ft. high.

The engine quickly fired up, and after a check of the panel we taxied out for takeoff. Flight instruments are mounted in front of the pilot. Radio is centered, with engine gages to the right. Tachometer and manifold pressure gage are below the radio. In a separate panel, on the left of the main panel, are switches for lights, electrical gear (which has a mechanical standby) and flaps, and starting.

Nose wheel of the Nibbio is linked to rudder pedals. There was little difficulty maneuvering around the many aircraft parked about the grass adjoining the runway and taxi-ways. Little brake action was necessary; brakes are hydraulic. As with most tricycle-geared aircraft, visibility was good during ground movement.

Wind at takeoff was practically on the nose, at 18-20 kt., with gusts up to 25 kt. Outside air temperature was 18C. Sea level pressure was 1,031 mb. Elevation of Le Bourget is 180 ft.

Twenty degrees of flaps were lowered for takeoff, and full throttle applied. The airplane was easily controlled by pedals and at about 50 mph. the nose wheel came up. At 70 mph. the air-

DUAL CONTROLS are standard in the Nibbio F.14. Plastic panels in side windows can be hinged inward during flight. Panel at far left mounts switches for booster pump, lights, electrical gear, flaps and starting. Fuel selector, trim controls are on bridge on floor.

MAX CONRAD's Dependable "NAVIGATOR" on His Record 7,668 Mile NON-STOP Flight was an ARC Type 21-A ADF...

TYPE 21A ADF WEIGHS ONLY 19.7 POUNDS

Component Unit Weights:
Receiver, 6.8 lbs.; Loop, 4.3 lbs.; Loop Housing, 0.5 lbs.; Indicator, 1.3 lbs.; Control Unit, 1.6 lbs.; Power Unit, 5.2 lbs.;
CAA Certificate No. 1R4-9 U.S. Military: AN/ARN-59
British Certificate of Approval VC-78

When, on June 4th, Max Conrad, happy but thirsty, ended his record-breaking flight from Casablanca to Los Angeles in a single engine Piper Comanche, he revealed that his only navigating instrument, besides a magnetic compass, was Aircraft Radio Corporation's latest, modernized version of the automatic direction finder. Mr. Conrad reported that he depended entirely on the ADF for radio navigation from point to point. The instrument performed "perfectly", he says, and was a continuous source of confidence.

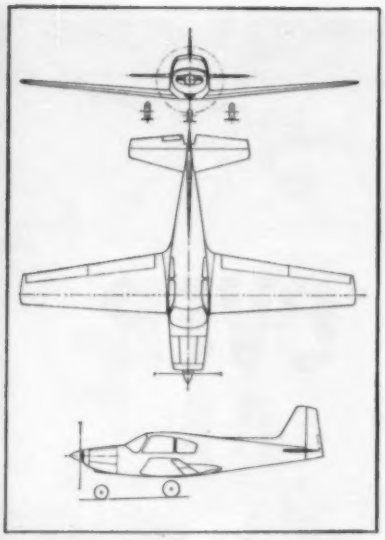
Join the thousands all over the world who fly confidently with ARC's ADF and other precision ARC equipment. See the ARC line at your dealer's.

Engineers: Investigate Career Opportunities at ARC

Aircraft Radio Corporation BOONTON, N. J.

Dependable Airborne Electronic Equipment Since 1928

OMNI LOC RECEIVERS • COURSE DIRECTORS • AUTOMATIC DIRECTION FINDERS • 360 CHANNEL VHF TRANSMITTER-RECEIVERS • GLIDE SLOPE RECEIVERS OMNIRANGE SIGNAL GENERATORS AND STANDARD COURSE CHECKERS • 900-2100 MC SIGNAL GENERATORS • 10-CHANNEL ISOLATION AMPLIFIERS UHF AND VHF RECEIVERS AND TRANSMITTERS (5 to 360 CHANNELS) • MARKER BEACON RECEIVERS • INTERPHONE AMPLIFIERS • CABIN AUDIO AMPLIFIERS



NIBBIO F.14 has a length of 23.6 ft. and a span of 31.2 ft. Wing area is 128 sq. ft.

plane was pulled off after a run of about 13 sec. Climbout, with gear and flaps up, was at 110 mph. Rate of climb initially was 1,200 fpm.

Controls were quite responsive during climbing turns, and straight-ahead airplane can be trimmed for hands-off ascent. Because of the time allotment at the air show, the Nibbio was leveled off at 4,000 ft. for cruise-speed runs and stall characteristics.

At maximum speed—pulling 2,700 rpm.—the F.14 indicated 202 mph. Dropping to 2,400 rpm., indicated speed was 186 mph. At 2,300 rpm., the airplane indicated 180 mph. With outside air temperature 10C, respective true airspeeds become 215 mph., 198 mph., and 192 mph.

The airplane was flown through varying degrees of banks and turns, with good results. Ailerons are quite efficient; their total area is 3.4 sq. ft., with up travel to 25 deg. and down travel to 16 deg. The company states that the rolling angular speed is 120 deg. per sec. at cruise speed and about 80 deg. per sec. at 93 mph. in landing configuration.

Stall Characteristics

The F.14 was stalled clean, power off, straight ahead. There was little buffeting preceding the stall (no stall warning indicator is mounted in this demonstrator), and the break was abrupt. The airplane did not fall off on the wing, but the nose dropped sharply straight ahead and recovery was rapid with loss of about 100 ft.

Nibbio is a clean airplane, and speed can build up rapidly during descent. Approach to Le Bourget was in a power-on spiral, and power-off pull-up was made to slow airspeed and lower gear, maximum speed for which is 124 mph. Circling approach was made, and full flaps (max. extension is 45 deg.) lowered at 115 mph. Total flap area is 4.2 sq. ft.

Our approach was made at 100 mph., holding in a small amount of power. Airplane was over the fence about 78 mph. and touched down about 65 mph., slightly nose high. The Nibbio was completely stopped within 500 ft.

First flight of the Nibbio was in September, 1957. To date, Aviamilano has produced 11 F.14s, all of which have been sold. There is no set production schedule, AVIATION WEEK was told, but the company aims at setting up a North America marketing arrangement wherein the airplane would be built in Italy, sent to the U.S. where engines and accessories would be supplied.

Standard instrumentation in the F.14 includes airspeed, artificial horizon gyro, rate of climb, altimeter, directional gyro, turn and bank, remote compass, tachometer, manifold pressure gage, engine gages, carburetor temperature indicator. Optional equipment offered includes 24-channel VHF, radio compass, and chronometer.

The company bases its annual operating costs for the Nibbio using the European costs of gas and oil ($3,750) and a depreciation figure (5 yr., residual value 20%, based on airplane cost of $20,000) of $3,200 annually, hangar rent and landing fees of $400, and insurance of $125, with and without a professional pilot as follows:

- **With professional pilot:** operating cost per aircraft hr., $23.68; operating cost per aircraft mi., $0.125; per passenger mi., $0.031.
- **Without professional pilot:** operating cost per aircraft hr., $17.39; operating cost per aircraft mi., $0.092; operating cost per passenger/mile, $0.023.

Map Survey Teams 47G-2, Tellurometer

Sacramento—California's Department of Water Resources has teamed a helicopter and a Tellurometer to achieve savings in time and money in establishing control surveys for mapping in remote and inaccessible areas.

The rugged terrain of the Eel River country in Mendocino County in northwestern California made it difficult to use traditional tape and transit methods in surveying for six proposed dam and reservoir sites planned by the department on the Eel River system.

By using the Tellurometer, a new electronic distance measuring device which measures distances directly by means of microwaves, the department's engineers were able to establish control points in areas where narrow canyons did not permit normal triangulation.

The savings of time and money were

COMPUTING COMPONENTS FROM Librascope

Shaft-to-digital encoders meet rigid requirements

Librascope shaft encoders meet and surpass rigid requirements of airborne analog-to-digital translation. Shock, vibration and temperature extremes do not affect their continuous, noise-free operation.

THEY'RE DIRECT: A simple one-step means of digitizing analog data.

THEY'RE RELIABLE: Multi-million turns at high speeds with constant contact resistance.

THEY'RE VERSATILE: 14 basic models in wide range of capacities; special function codes built-in to simplify computer requirements.

For full details on Librascope encoders write for Catalog E11-1

OUTPUT CODE	MODEL NO. ◎	TOTAL CAPACITY	RESOLUTION PER TURN
PARALLEL BINARY (LINEAR)	740	10 bits (1024)	1024
	743	13 bits (8192)	128
SERIAL BINARY (LINEAR)	707	7 bits (128)	128
	713	13 bits (8192)	128
	717	17 bits (131,072)	128
	719	19 bits (524,288)	128
SERIAL BINARY (SIN-COS)	757†	7 bits per quadrant* (4 quadrants)	512
	758†	8 bits per quadrant* (4 quadrants)	1024
BINARY CODED DECIMAL (8-4-2-1)	723	2,000	200
	724	20,000	200
	733	3,600	200
	734	36,000	200
	735	360,000	200
GRAY	708	8 bits (256)	256

◎ All models available with internally mounted isolation diodes for sequential multiplexing applications.

†Available in hermetically sealed servo-driven package as Models 757-8 and 758-8.

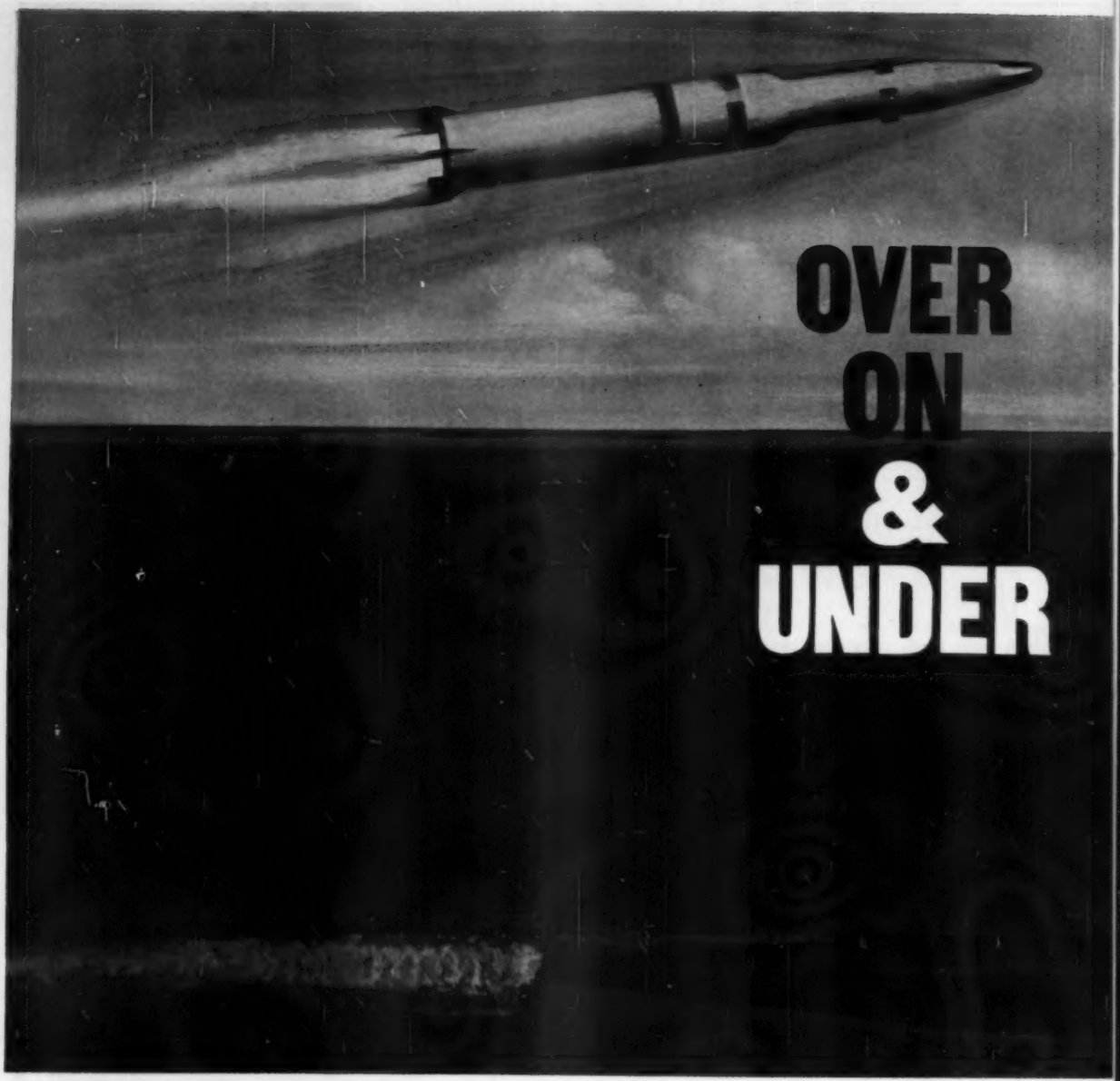
*Including limit 1 and polarity information. Sine and cosine functions generated simultaneously and independently. One turn of shaft generates 4 quadrants of information.

LIBRASCOPE A GENERAL PRECISION COMPANY

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

LIBRASCOPE, INC. Commercial Division

100 East Tujunga Avenue • Burbank, California



A missile streaking through the sky . . . a ship plowing through the ocean swells . . . a submarine gliding through the depths . . . all guided with unerring accuracy by Autonetics' inertial navigation systems.

Twelve years ago development was under way on the first Autonetics' inertial autonavigator—a system to guide a supersonic missile to a distant target.

Since then, refined versions of this system have shown remarkable capability for guidance over, on and under the terrestrial surface in any craft, at any speed, under any conditions . . . a significant advance in the state-of-the-art.

It was an Autonetics' autonavigator that guided an aircraft on the first successful daylight cross-country flight by stellar-inertial autonavigation. Another version

Inertial navigation

easily passed the Navy's exhaustive sea tests aboard the USS Compass Island in 1957. And in 1958, Autonetics' systems guided the USS Nautilus and Skate on their historic voyages under the polar ice.

Today Autonetics is producing the systems to guide the Air Force's GAM-77 missile and the Navy's Polaris-carrying submarines. Its engineers are designing systems for the Minuteman intercontinental ballistic missile. Even more advanced systems will provide the accurate stellar-navigation data needed to guide man on his travels through Outer Space.

But the imaginative engineering that brought inertial navigation so far, so fast, is only half the Autonetics' story. New ideas had to be implemented by new manufacturing techniques. Many components of inertial autonavigators—gyroscopes, accelerometers and computer elements—called for precision that was once impossible. Now Autonetics has put 't on the production line.

These are the achievements that have given here-and-now reality to inertial navigation . . . and have made Autonetics first in the field.

by Autonetics

A DIVISION OF NORTH AMERICAN AVIATION, INC., DOWNEY, CALIFORNIA • REGIONAL OFFICES: WASHINGTON, D. C. AND DAYTON, OHIO

INERTIAL NAVIGATION / ARMAMENT CONTROL / FLIGHT CONTROL / COMPUTERS AND DATA PROCESSING

USAC TRANSPORT INC

BETWEEN
ALASKA
AND ALL
THE OTHER
STATES

OUTSIZED
AND
GENERAL
COMMODITY
CARGOES

DO YOU
KNOW ABOUT
U.S.A.C.
TRANSPORT?

WRITE FOR
BROCHURE

457 WEST FORT ST.
DETROIT 26, MICH.
TWX DE899 WO 3-7913

Russians Criticize Lack Of Light Turbojets

Moscow—An immediate speedup in development of a light turbojet powerplant suitable for installation in an airplane capable of setting international sports records is demanded by the Russian Air Force newspaper Sovetskaya Aviatsiya.

Construction of a suitable light jet sport plane has lagged despite numerous requests for such a type. The newspaper asserts it is "intolerable" that the United States continue to lead the USSR in certified lightplane records.

further enhanced by employing a helicopter to hop between control stations with men and equipment where otherwise pack animals would have had to be used.

Use of the helicopter was indicated by inaccessibility of much of the area by motor vehicles, further complicated by a limited number of roads, and heavy rainfall in the area. It was estimated that field surveys by ground travel for six reservoir areas under consideration would cost about $12,600. The same surveys accomplished by helicopter would cost an estimated $9,100, thereby resulting in savings of some $3,500.

Apart from the use of the helicopter, use of the Tellurometer will have resulted in savings of about 50% compared with traditional tape and transit methods, it is expected, although final cost comparisons have not yet been made.

In the surveying operations in the Eel River country the Department of Water Resources measured 116 lines with the Tellurometer system, ranging from a line as short as one-third mile to a line 12 mi. long. The work was carried out in rugged country on various forks of the Eel River for the dam and reservoir sites at Dos Rios, Willis Ridge, Etsel, Mina, Caution and Junction.

Crews were able to complete in a few weeks work which would have taken several months by normal tape and transit methods.

Using the Tellurometer, but without helicopter, it was estimated the surveys conducted by ground travel would require eight party-months to complete. The same work was accomplished in two-and-one-half party-months by helicopter travel, allowing five-and-one-half months of survey party time to be devoted to other high priority projects.

Use of the helicopter eliminated or reduced costs for such items as pack animals (three horses at $5 a day and packer at $15 a day for 10 days) and major reduction in costs for salaries and living expenses of personnel in the field.

The helicopter flights were made from April 6 to May 9 using a Bell 47G-2 helicopter, adequate to land and take off at elevations of 6,800 ft. with a payload of 500 lb. for a one-and-one-half-hour flight. Flying was done by Sam Thrasher of Utility Helicopters, Bakersfield, Calif. The work was carried out under the direction of Carl King, head of the maps and surveys section of the Division of Resources Planning, State Department of Water Resources, Sacramento, Calif.

Westinghouse F-27 Wins Two Top Design Prizes

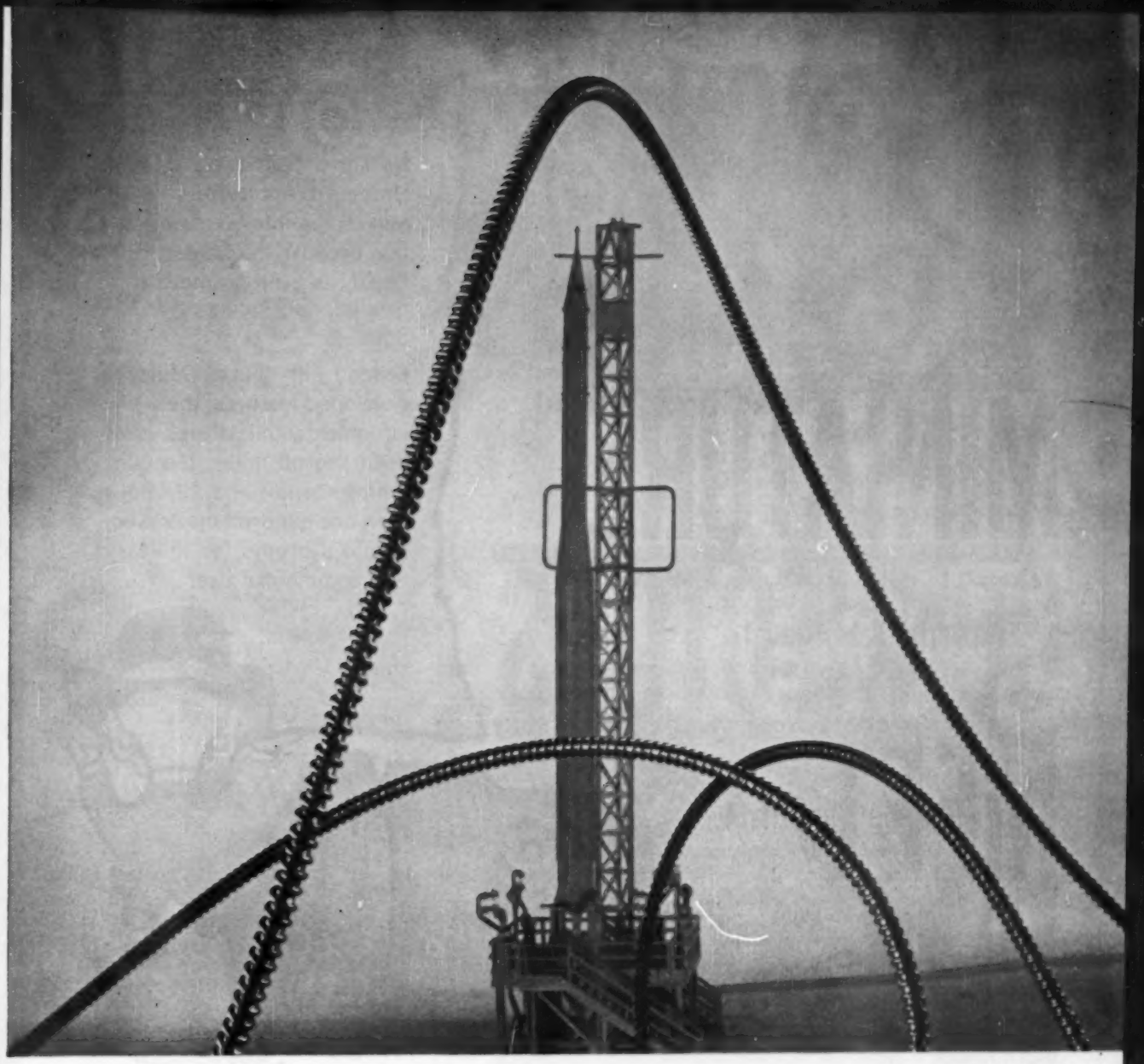
Executive Fairchild F-27 turboprop transports took two top prizes at Reading Aviation's 10th annual maintenance and operation meeting. Westinghouse F-27 was selected as Flagship of the American Business Fleet for 1959, based on design, construction, maintenance, equipment, crew and interior (designed and installed by Horton & Horton). Curly Korb, F-27 chief pilot, accepted a silver trophy. Noland Co., (Karl Styne, chief pilot), received first prize for best interior design, planned by Dave Ellies of Industrial Design. Approximately 13 F-27s are now in service as executive transports.

PRODUCTS

AN-1048/U ANTENNA
AS-25/APT ANTENNA
AS-26/APR-2 ANTENNA
AS-37/APT-4 ANTENNA
AS-44/APR-5 ANTENNA
AS-56/SPR-1 ANTENNA
AS-57/SPR-1 ANTENNA
AS-65/APQ-2A ANTENNA
AS-67/APQ-28 ANTENNA
AS-69/APT ANTENNA
AS-115/APT ANTENNA
AS-124/APR ANTENNA
AS-125/APR ANTENNA
AS-148/ARA-8 ANTENNA
AS-168/AP ANTENNA • CW-234/AU ANTENNA SHIELD • SA-14/SPR-1 R. F. SWITCH • GAGW-66132 ANTENNA
AT-49/APR-4 ANTENNA • SA-44/APR R. F. SWITCH • F-29/SPR-2 HIGH PASS FILTER • CAGW-66131 ANTENNA
AT-234/APX ANTENNA • SA-56/SPR-1 R. F. SWITCH • 44B11182 GUN TRUNNION BRACKET

Precision manufacturing and intricate assemblies are our specialty.
Only Air Force approved source for Antenna AN[illegible] B.
Complete test facilities for all types of antennas.
Overhaul & Modification of electrical & mechanical devices.
We have yet to be late with a delivery on any order of prime contract.
Try our service for promptness and satisfaction.

R. A. MILLER INDUSTRIES, INC.
1525 Marion St., Grand Haven, Mich.



How to remotely adjust valve positions with 18000° rotation and .00055% accuracy. Or...

how to put a remote control system in 1/9 the space and save 54%-60% on weight. Or, get 95% efficiency in a 90° bend. Or, design around any bend without intermediate links or pulleys for precision response far beyond the range of any other control system.

The "how" is with TELEFLEX® systems. The "why" is the exclusive TELEFLEX helix wire cable design. No remote control cable anywhere gives such high sensitivity and response . . . such a reduction in weight and backlash . . . such design freedom with straight line, angular *and* unlimited rotary motion!

The technical advances made possible with TELEFLEX cable mean that TELEFLEX engineers have gone further and can offer *more* in the development of complete mechanical control systems for any purpose. Write for our new catalog . . . or help on your specific problem. TELEFLEX Incorporated, North Wales, Pennsylvania.

TELEFLEX SYSTEMS offer unequaled design flexibility because they are the only systems to offer all three types of mechanical motion...

TELEFLEX®
INCORPORATED

DEUTSCH DM SERIES MINIATURE CONNECTORS MEET * NEW MIL-C-26482

*or exceed

Bulletin: DM is MS...

Now you can freely design these advanced push-pull miniatures into your application because the Deutsch DM Series is built to meet this new miniature connector Mil Spec.

Loaded with special Deutsch-developed features, these environmental miniatures have been proved under the punishing conditions of more than one hundred major electronic systems for military and commercial use.

- quick disconnect
- environmental
- unique ball-lock coupling
- moisture sealed
- vibration dampened
- continuous dielectric separation without voids
- positive lock without safety wiring
- operation to 250°F.

For complete technical information, contact your Deutsch Representative or write us for Data File H71.

See us at WESCON, Booth 611-613

The Deutsch Company
7000 Avalon Boulevard • Los Angeles 3, California

© THE DEUTSCH COMPANY, 1959

WHO'S WHERE

(Continued from page 23)

Changes

Walter B. Brewer, manager, Airborne Systems and Test Department, Atlas Program Office, Space Technology Laboratories, Inc., Los Angeles, Calif. Also: **W. H. Edwards,** manager of STL's Field Office at Warren AFB, Cheyenne, Wyo.

Paul F. Boggess, chief engineer, Power Systems Department, Hallamore Electronics Division of the Siegler Corp., Los Angeles, Calif.

James W. Ashby, general manager, Janitrol Aircraft Division of Surface Combustion Corp., Columbus, Ohio. Also: **Joseph F. Hill,** manager of engineering.

W. E. Metzger, head of the new Dayton, Ohio, field engineering office for Whittaker Controls Division of Telecomputing Corp., Los Angeles, Calif.

Thomas P. Peppler, project manager, and **Harvey H. Klein,** project engineer for the YHC-1B helicopter program, Vertol Aircraft Corp., Morton, Pa.

Carlisle M. Thacker, technical director, Taylor Fibre Co., Norristown, Pa.

Gabriel C. Danch, manager of the Washington, D. C., office, U. S. Industries, Inc.

Dan L. McGurk, sales manager, Thompson Ramo Wooldridge Products Co., Los Angeles, Calif. **Louis B. Perillo** succeeds Mr. McGurk as contracts and proposals manager. Also: **Henry L. Bechard,** products manager.

The West Coast Missile and Surface Radar Department of Radio Corp. of America, Los Angeles, Calif., has appointed the following managers: **Richard T. Barrett**-government contracts; **Charles Z. Becker**-Atlas ICBM contracts; **John Q. Whitehead**-custom aviation equipment sales.

Henry P. Steier, corporate director of public relations, Lear, Inc., Santa Monica, Calif.

Dr. Morris Feigen, manager, Engineering Design Department, Vehicle Development Laboratory, Space Technology Laboratories, Inc., Los Angeles, Calif. Also: **Philip N. Anderson,** assistant manager, Engineering Design Department; **Lloyd G. Ludwig,** staff assistant to the director of the Vehicle Development Laboratory.

George F. Kennard, manager, Engineering Laboratory, Owego, N. Y., Federal Systems Division, International Business Machines Corp.

John C. Geist, technical operations manager, Vitro Laboratories, Silver Spring, Md. Also: **Benjamin O. Delaney,** assistant manager for missile operations.

Elwood D. Bryant, assistant to the manager of operations, Convair (Astronautics) Division of General Dynamics Corp., San Diego, Calif.

Douglas B. Annan, sales manager, Guided Missiles Division, de Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada.

Donald G. Sturges, associate director, Research and Development Division, The Carborundum Co., Niagara Falls, N. Y. **Frederick J. Ross, Jr.,** succeeds Mr. Sturges as manager-new products development branch. Also: **Dr. Wingate A. Lambertson,** assistant manager-engineering research branch.

Structures Engineers

The Columbus Division of North American Aviation, Inc. is seeking senior structures engineers for design, development and analysis on advanced projects, both aircraft and missiles.

Structural Analysts

Capable of computing internal load distributions and analyzing complex structures. Assignments include solution of redundant structures, loads distribution, structural testing or preliminary design support.

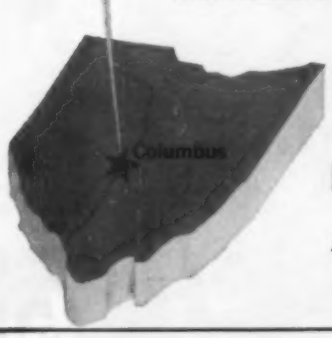
Airframe Designers

Will be assigned to an integrated structural group where the opportunity to calculate your own stresses along with responsibility for laying out airframe components is available.

Weights Engineers

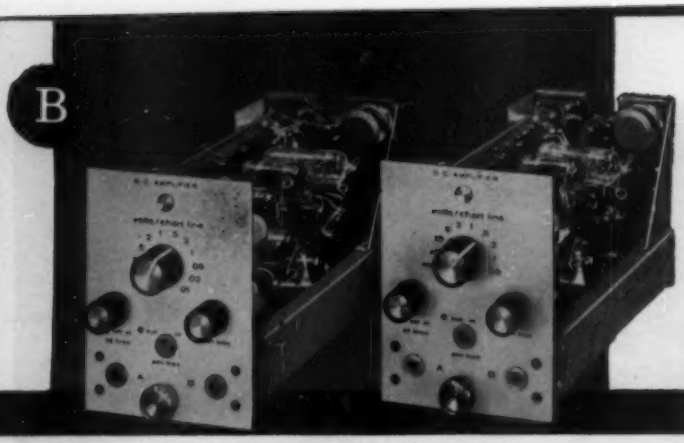
To analyze airframe structures from a weights standpoint, determining techniques for improving estimating methods on new types of structures and materials.

Reduce your working day by living close to the office in suburban Columbus. For more information, write to Engineering Personnel, Box 428, North American Aviation, Inc., Columbus, Ohio.



THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION, INC.

Home of the T2J Buckeye and the A3J Vigilante



Brush 6-8 channel recording system

RECTILINEAR . . . COMPACT
PRECISE . . . SIMPLIFIED!

THE new Brush 6-8 channel recorders are designed to give highest reliability and preciseness to readouts for telemetry, computer, ground control and other data gathering systems—with a maximum of simplicity.

A **Complete 6 or 8 channel system** includes slide mounted oscillograph—signal conditioning amplifiers—requires only 20″ of rack height.

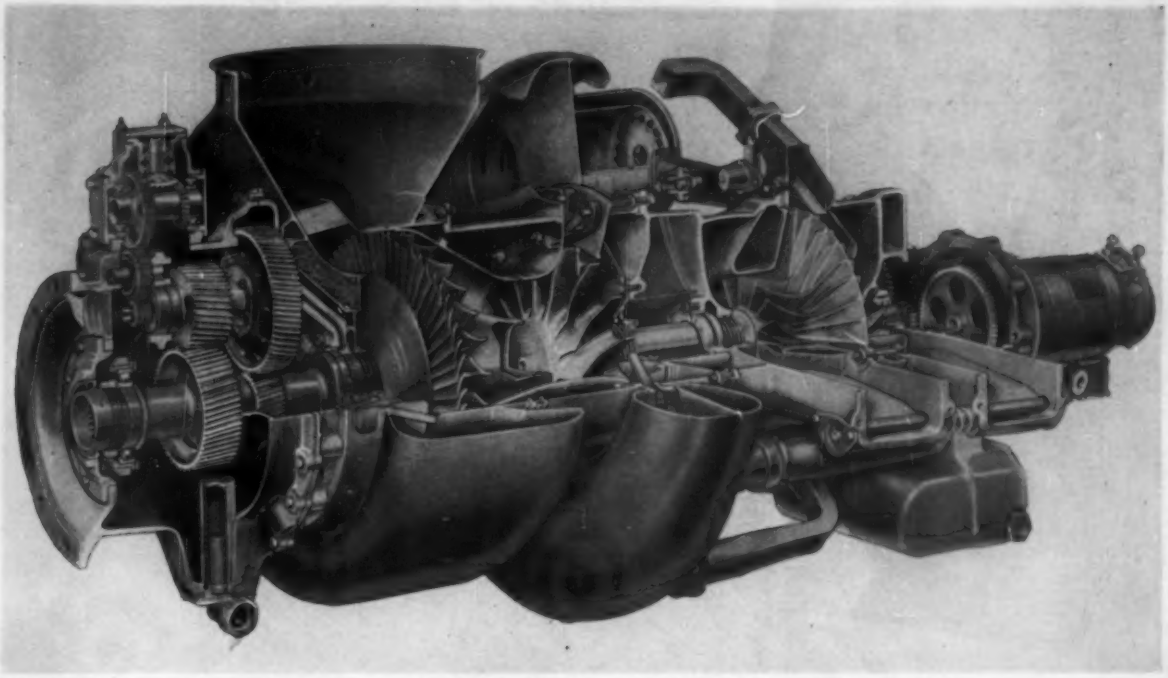
B **Interchangeable plug-in signal conditioners.** In addition to amplification, four important functions are provided: high input impedance, zero suppression, attenuation and calibration.

C **"Pull-out" horizontal writing table** permits convenient annotation, reading and control —without removing chart paper or turning off recorder.

D **Rectilinear presentation** gives clear, uniform and reproducible traces for simplified analysis and interpretation. Excellent resolution at all amplitudes and recording speeds.

For further details or application assistance, contact your Brush factory branch or engineering representative.

brush INSTRUMENTS
DIVISION OF
37TH AND PERKINS · CLEVITE CORPORATION · CLEVELAND 14, OHIO



CUTAWAY view of Boeing 502-2 gas turbine engine which is officially designated T60-BO-2 under Navy contract.

Boeing Tests Lightweight Gas Turbine

By Richard Sweeney

Seattle—Working to design specifications which call for 400 hp. with a specific fuel consumption of 0.72, Boeing Airplane Co.'s Industrial Products Division currently is operating the model 520-2 turboshaft gas turbine engine on a test stand at 440 hp. with sfc. of 0.71. The engine weighs 325 lb.

Officially designated the T60-BO-2 under the Navy development contract for a small turbine for helicopter applications, the powerplant incorporates design information and lessons Boeing learned in its program of developing the Model 502 small gas turbine engine.

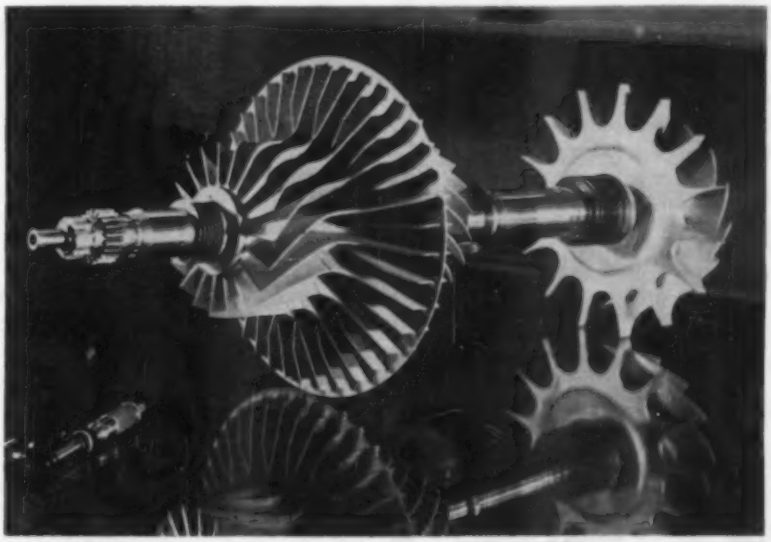
Four Variations

Currently there are four variations of the powerplant—520-2, -4, -6 and -8, with the -2 and -6 aimed at helicopters, the -4 and -8 at turboprop aircraft.

All engines are free turbine types. The -6 and -8 are improved versions of the -2 and -4, with increased power and better specifics. The -6 is rated at 545 eshp. for takeoff and 484 eshp. for normal operating, with specific fuel consumptions of 0.63 and 0.65 respectively. The turboprop -8 ratings and specifics are 530 eshp. and 479 eshp. 0.63 and 0.68 for takeoff and normal operating, respectively.

For the 520-2 and -4, the ratings are -2 military rating, 400 shp. and 0.72 sfc.; normal, 350 shp. at 0.76 sfc. For the -4, takeoff rating is 495 eshp. at 0.68 sfc., normal operating, 394 eshp. at sfc. of 0.73.

Design is a lightweight, two-shaft philosophy, with gas generator and power output sections as separate entities. Gas generator section uses four air inlet tubes which send flow into the double entry, high tip speed centrifugal impeller. Air passes into vaneless portion of diffuser at transonic velocity, progresses through vaned diffuser section and enters the collector plenum



ENGINE'S inducer-impeller at left on main rotor; gas producer turbine is at right.

37TH AND PERKINS CLEVITE CORPORATION CLEVELAND 14, OHIO

Dry, Positive Prints, Ready for Immediate Use, at Only a Fraction of Former Reproduction Costs!

Push a button on a XeroX® Copyflo® printer, and dry, positive copies emerge in seconds, ready for immediate use.

PUSH THE BUTTON... *and copies flow!*

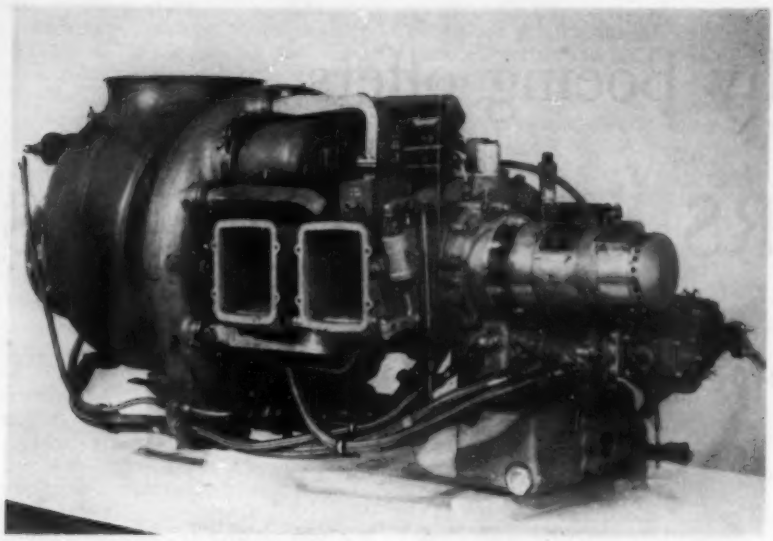
Costs are dramatically reduced. Xerographic copies of engineering drawings are so inexpensive that in many plants engineers are urged to discard them rather than re-file.

You can copy up to 1,200 *different* drawings an hour with a Copyflo printer. Copies may be on ordinary paper, vellum, or offset paper masters . . . And the quality is superb—precisely like the original—because xerography *copies the quality, too.*

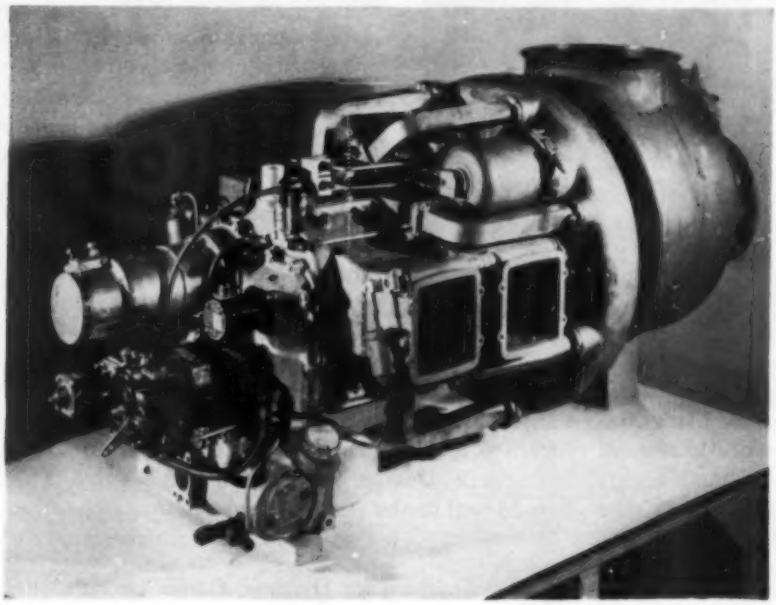
If your need is to copy hundreds . . . or thousands . . . of different documents daily, look to automatic xerography for the happy solution. Copyflo printers enlarge, reduce, or copy size to size—can automatically turn out copies as rapidly as 20 linear feet a minute.

Copyflo printers offer the fastest, most flexible, most economical way to get sharp, back-on-white copies from original documents of all kinds or from microfilm. For complete details, write for booklet X-287, HALOID XEROX INC., 59-103X Haloid St., Rochester 3, N. Y. Branch offices in principal U. S. and Canadian cities. Overseas: Rank-Xerox Ltd., London.

HALOID XEROX®



BOEING emphasis on simplicity in design is shown in these side views of the company's new Boeing 520 gas turbine engine. Design philosophy embodies single stage elements to ensure ruggedness and cut production and maintenance costs.



via eight diffuser tubes. Pressure at entry is 6.5 atmospheres.

Combustion chambers are reverse flow type and air flows between the burner liners and outer shells on the way from the plenum chamber to the main burner liner entry ports. En route some air flow is allowed to enter the burner liner along the side by perforations, although main flow is through the primary ports at burner can dome.

Duplex Nozzles

Two burner cans are used on the engine, each can having duplex fuel injector nozzles. From the burner can, combustion gases enter a plenum surrounding the gas producer nozzle ring, which directs them into the radial turbine which drives the compressor. Leaving this turbine, gases have lost two-thirds of their energy and pressure.

Gas Passage

Gases pass through the free power turbine next, which has reduction gearing appropriate to the application; i.e., for rotorcraft or fixed wing aircraft, thence to an internally splined output shaft.

After gases pass through the power turbine, they are near atmospheric pressure for exhaustion either at low velocity through an open duct or at high velocity through appropriate noz-

Expanding the Frontiers of Space Technology in

TELEMETRY

■ Telemetering at Lockheed has been brought to a high degree of successful application in the integration of circuits and components into high-performance systems. A completely sub-miniaturized FM-FM system has been developed, along with a complete PAM-FM system characterized by highly efficient band-width utilization, low power consumption and economy of size and weight. This represents a significant achievement in the field of high capacity telemetry.

Other Lockheed designed and developed equipment is successfully providing highly accurate telemetered information on temperature, pressure, acceleration, vibration, thrust, vehicle attitude and other conditions during actual hypersonic flights.

ENGINEERS and SCIENTISTS

Lockheed Missiles and Space Division has complete capability in more than 40 areas of science and technology. Its programs reach far into the future and deal with unknown environments. It is a rewarding future with a company that has a record of continual progress. Engineers and scientists of outstanding record are invited to join us in contributing to the nation's progress in space technology. If you are experienced in one of the above areas or in related work, please write: Research and Development Staff, Dept. G2-17, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship required.

Lockheed

MISSILES AND SPACE DIVISION

Systems Manager for the Navy POLARIS FBM; DISCOVERER SATELLITE; Army KINGFISHER; Air Force Q-5 and X-7

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA
ALAMOGORDO, NEW MEXICO • HAWAII

Why Boeing offers

ENGINEERS and SCIENTISTS

better opportunities to advance

If there is a lingering doubt in your mind about the future in your present position, this message will be of particular interest—and value—to you.

Opportunities for advancement are tied very closely to the growth prospects of the company you're with. Boeing, for instance, is expanding rapidly in areas with an extremely long-range future—missiles and space-age projects. This growth provides outstanding opportunities for engineers and scientists to move up to higher levels of responsibility and income. It also promises career stability. Another advantage you enjoy at Boeing is a dynamic career environment that's conducive to rapid advancement. You work in a small group, with high visibility for your individual talents and accomplishments. You are encouraged to take graduate studies in your special field, at company expense. You're eligible for management courses designed to help you get ahead faster.

Assignments at Boeing are on some of the most exciting projects in the country: a boost-glide vehicle; Minuteman, an advanced solid-propellant intercontinental ballistic missile system; BOMARC, the nation's longest-range supersonic defense missile; jet aircraft of the future; and company projects including orbital, lunar and interplanetary space systems.

There are challenging, get-ahead opportunities at Boeing, now, for engineers and scientists of virtually all experience levels, with educational backgrounds from B.S. to Ph.D. Openings are available now in Research, Design, Production and Service. They could well be the answer to *your* future.

Write *today,* for your free copy of the 24-page book "Environment for Dynamic Career Growth."

MR. STANLEY M. LITTLE, Boeing Airplane Company,
P. O. BOX 3822-ANE, Seattle 24, Washington.

Send me the Boeing career booklet by return mail.

*Name*_____

*Address*_____ *City*_____ *State*_____

*Degree(s)*_____ *Field of interest*_____

*Experience*_____

zles to take advantage of jet thrust.

Maximum envelope sizes are 25 in. dia. and 57 in. length for the 520-2, same diameter and a length of 59 in. for the 520-4; the -6 has the same envelope as the -2, while the -8 duplicates the -4.

Design features of the various components, according to Boeing, include a tip speed for the single-stage, double-faced radial compressor rotor of 1,750 fps., with the double-face design contributing to good stress distribution. The single stage radial turbine is well matched to the compressor, according to the company, and eliminates the need for two-stage axial turbine and attendant greater complexity and weight.

Location of the two cup type burner cans at the top of the engine allows easy access for maintenance, Boeing points out, while the short distance between the burners minimizes cross fire and ignition problems. In addition, the company says, since the burners are free at one end, thermal expansion stresses and distortion of nozzle boxes are eliminated.

A torch igniter is used which requires only one igniter plug.

Constant Power

Free power turbine provides, according to Boeing, essentially constant power over one third of the output shaft speed range for any selected compressor speed, simple controls are required for accurate matching of engine output to applied load.

The closed loop gas generator speed governor is designed, says Boeing, to vary fuel flow at a rate of 10 times faster than speed can change, providing a "stiff" and stable control of both gas generator speed and output power. Constant and stable free power turbine speed is readily obtained with a simple closed loop speed-torque governor. Load torque must be changeable at a rate 10 times faster than the free turbine speed can change.

Speed Governor

For applications in which load torque is independently varied, but control of power turbine speed is desired, a free turbine speed governor is used which sets the demand speed for gas generator speed governor as required to meet the applied load.

A closed loop speed-position governor will provide stable and "stiff" control, Boeing indicates.

Both rotor assemblies, Boeing says, are proportioned and supported so that first-order natural frequency modes occur above the highest operating speed.

Radial and thrust bearings of both main rotors support the applied loads on hydrodynamic films. Any rotor mass eccentricities, Boeing declares, produced by assembly tolerances and operational rotor blade deterioration are completely absorbed within the radial bearing tolerances provided.

Applications Boeing is pushing for the powerplant include the business and executive aircraft market for fixed wing types, plus VTOL and STOL vehicles, helicopter and shrouded rotor machines.

British Reveal Aviation Outlays

London—British Ministry of Supply spent $1.5 billion on research and development in the aircraft industry between April, 1949, and March, 1959, according to Supply Minister Aubrey Jones.

Giving the information in reply to a parliamentary question, Jones said it would not be in the public interest to break the total into annual outlay.

In response to another question, Jones gave a yearly breakdown for the past decade of Ministry of Supply expenditures on military orders for aircraft, aero-engines and aircraft components.

It showed a curve rising from $204.4 million in 1948-1949 to $761.6 million in 1954-1955, dropping to $660.8 million in 1955-1956, rising again to $722.4 million in 1957-1958.

An almost limitless number of standard Vee-Band Couplings are available to meet your exact requirements. Numerous latch styles and clamp designs enable NUCO's nationwide sales-engineer staff to solve your coupling problems today.

NATIONAL UTILITIES CORPORATION
826 So. Arroyo Parkway • Pasadena, Calif.
SYcamore 3-6663 or MUrray 1-9637

Write for Catalog No. 12

NUCO

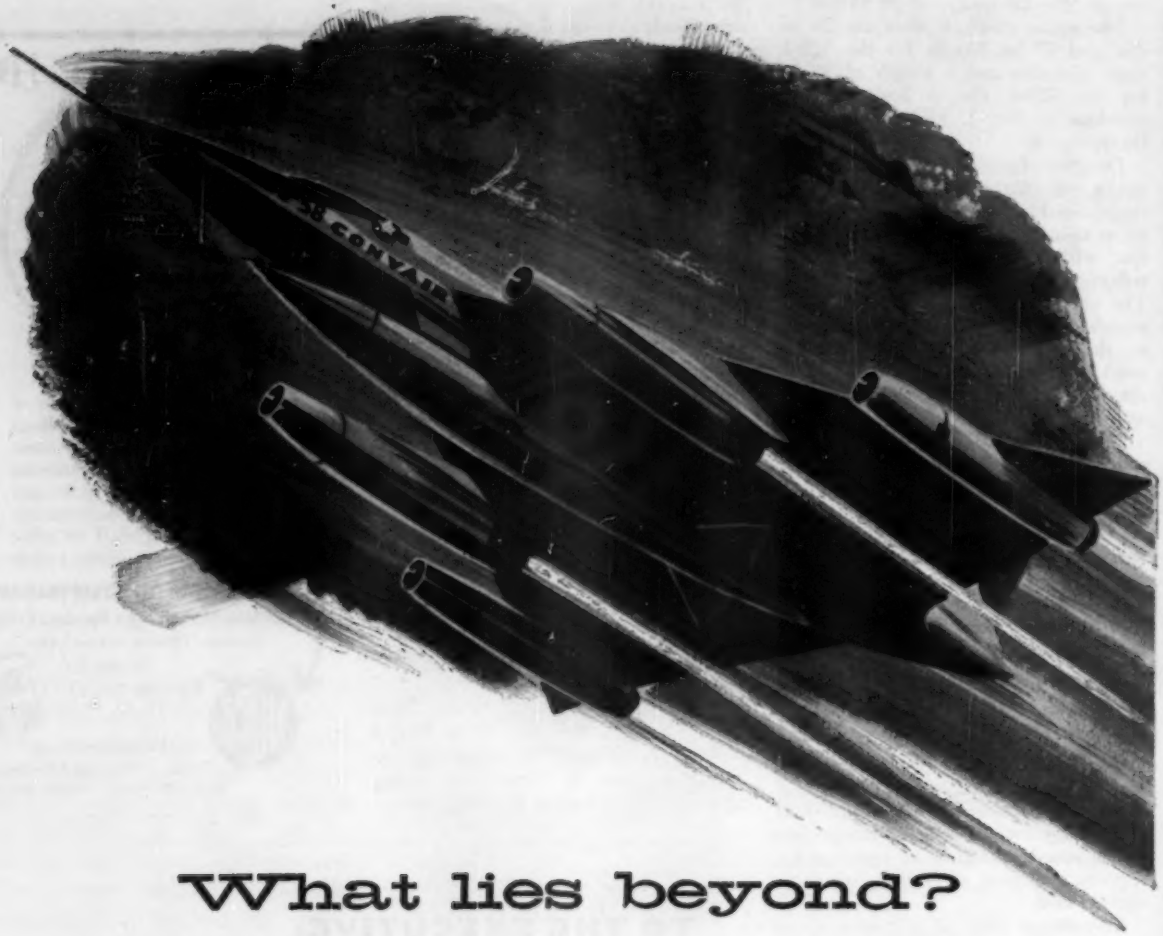
Manufacturers of
Clamps • Couplings • Flanges
Strap Assemblies • Special Designs

TO THE EXECUTIVE:

Before you advance to pressurized aircraft, as so many leading corporations have already done, you and your associates are invited to combine one of your next business trips with the first-hand experience of a flight aboard the ultimate in corporate aircraft design, the AiResearch custom-converted Convair 240 Executive Ayer-Liner . . . priced at only $385,000.
To coordinate your arrival and departure schedule to and from your desired destination, contact Jim Welsch, Vice President of Sales.

FBA
WORLD-WIDE
AIRCRAFT CENTER

FREDERICK B. AYER & ASSOCIATES, INC.
250 PARK AVENUE, NEW YORK 17, N. Y.
MURRAY HILL 7-1800



What lies beyond?

This eternal enigma has generated a new concept of the engineering organization at Convair/Fort Worth . . . blending the contributions of each individual into the best combination of ideas through highly inter-related, smooth flowing and carefully coordinated functions. The imaginative thinking resulting from this finely-drawn engineering organization is currently exemplified by the B-58, which a few short years ago lay beyond the then-known state of the art.

Experienced, well-trained men, seriously interested in projects to stimulate and satisfy an inquiring mind, and in freedom to exercise creative ability, are invited to investigate the engineering opportunities in the continual search for new ideas . . . new concepts . . . at Convair/Fort Worth.

Complete details are available on request. Send a resumé of your training and experience for *evaluation by engineers* in the area best suited to your qualifications. Do it now . . . your contribution may be precisely what we need, particularly if your capabilities are in the areas of electronics, radome design and test, structures, or structural design.

CONVAIR / FORT WORTH

P. O. BOX 748-A

A DIVISION OF

GENERAL DYNAMICS

NEW AVIATION PRODUCTS

Aircraft Fuel Cell

Rubberized nylon fuel cell, designed to withstand 30g impacts, will be used on Army YHC-1A and H-21 helicopters.

Tank, called Safety Cell, reduces the possibility of combustion in the event of a crash. Developed in cooperation with the Federal Aviation Agency, the fuel cell, enclosed in a wing section, has withstood 100 mph. impacts against a sand bag barrier.

Goodyear Tire and Rubber Co., Akron, Ohio.

Enamel Safety Paint

"Day-Glo" fluorescent safety paint, formerly produced only as an acrylic lacquer, is now available in an alkyd enamel.

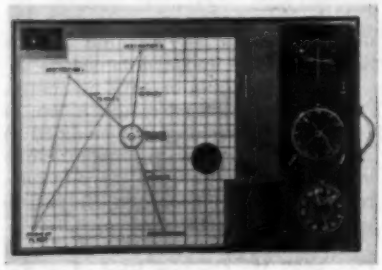
Enamel can be brushed or sprayed on aircraft and is available in orange, red, green and yellow. Production of lacquer paints will be continued.

Switzer Brothers, 4732 St. Clair Ave., Cleveland, Ohio.

Navigation Training Aid

Training device is designed to instruct flight personnel in the theory and operation of VOR/DMET systems.

LAS Model 105 utilizes a movable aircraft silhouette positioned on a co-



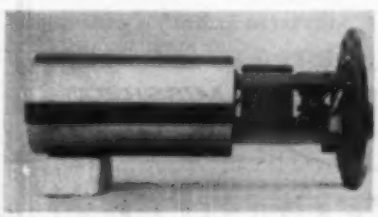
ordinate-type display panel, simulated beacon and instrument and control mockups. An approach horizon indicator, a radio-magnetic indicator and a Tacan digital range indicator are incorporated. Selector switches, indicator light and a rotating light beam representing station radar sweep are simulated. Display panel measures 48 x 32 in. The unit is contained in an aluminum case and operates on 115 v., 60 cps. electric current.

Special Services Division, Lockheed Aircraft Services, Inc., Ontario, Calif.

Missile Instrument Cartridge

Instrument cartridge gathers launch data during test-launching of dummy Polaris missiles. The 176 lb. package can withstand shock of some 1,000g.

Cylinder, carrying 15 lb. of encapsulated instruments, is capable of withstanding water immersion for more than two days at 75 psi. Power source is a



28 v. 6 amp. battery pack with a life of 10 min. Instrumentation includes a 14-channel recorder, three accelerometers, two rate gyros, transistorized amplifiers, control and calibration circuits, a static inverter and a demodulator package. Missile cartridge may be adapted for sled tests and missile free flight.

Leach Corp., Compton, Calif.

Fuel Vapor Adsorber

Vapor adsorber eliminates fuel vapor around fueling aircraft. Activated charcoal in tank adsorbs vapor collected as it escapes from wing vents. Atlas vapor removal unit, intended for use by military services and jet-equipped airlines, is produced by International Industrial Development Consultants, New York.

Ignition Accessories Tester

Ignition accessories test console tests cables, spark plugs and ignition units of

MISSILE ENGINEERS

Inauguration of a new weapons systems program at Raytheon has created exceptionally rewarding openings for Junior and Senior engineers with missile experience in the following areas:

Microwave design—component and antenna
Aerodynamics
Communications systems
Digital programming
Guidance systems
Radome design
Computer systems
Heat transfer
Radar systems
Inertial reference systems
Feed-back control
Auto-pilot
Ground support
Electronic packaging
Radar systems—project management
Electromechanical engineering background in missile control and auto-pilot design—project management
Mechanical engineering background in ground handling of large missile systems—project management

Living and working in the suburban Boston area offers many advantages. Relocation assistance and liberal benefits.

Please forward resume to:
Mr. W. F. O'Melia
Employment Manager
Raytheon Company
Bedford, Massachusetts
or call collect:
CRestview 4-7100
Extension 2138

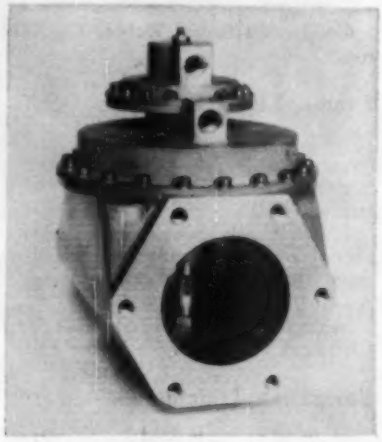
RAYTHEON MISSILE SYSTEMS DIVISION

jet engines at simulated high altitudes. Vacuum chamber, measuring 24 x 24 in., can simulate a pressure altitude of 120,000 ft.

Test console, designated Model 9725 has two power supplies. The primary accepts either a.c. or d.c. input. Fully regulated, the a.c. output ranges of the primary supply are 320 to 520 cps. with 0 to 240 v.

The other power supply provides voltages from 0 to 5,000 v. for testing cables.

George L. Nankervis Co., 15400 Fullerton Ave., Detroit 27, Mich.



Hydrogen Relief Valve

Relief valve, designed to handle liquid and gaseous SF-1 fuel, is intended for advanced rocket fuel systems.

Valve has undergone tests with liquid SF-1 fuel at −430F and gaseous SF-1 at −220F and maintained its design control of 3.0+ or −0.2 psia range. Ambient temperature range is up to 250F and the valve can be modified to provide 500F ambient service. Units have been built for gage pressure control and absolute pressure control in line sizes up to 3 in. ID.

Air and Gas Division, Parker Aircraft Co., 5827 W. Century Blvd., Los Angeles, Calif.

Pneumatic-Instrument Tester

Barodyne, precision pressure verification instrument, is capable of field testing either single or dual pressure devices, to an accuracy of .05% of full scale.

Barodyne 700 Series is designed for dual pressure instruments including jet engine duct throat Mach number controls, liquid propellant balancing systems, and Machmeters. The 800 Series, for single pressure equipment including barometric altitude controls, and absolute and differential altimeters, can be used as an analog-to-pressure or pressure-to-analog converter.

U. S. Science Corp., 5221 W. 102nd St., Los Angeles 45, Calif.

RADAR ENGINEERS *and* SCIENTISTS

THE MITRE CORPORATION

Announces the Formation of its New Department:

RADAR SYSTEMS *and* TECHNIQUES

MITRE, organized under the sponsorship of the Massachusetts Institute of Technology with a staff nucleus composed of the men who developed the SAGE System, is now activating a Radar Systems and Techniques Department. The principal function of this new department will be research and development of advanced detection systems and techniques applicable to the nation's future air defense.

The work to be performed by this department will afford the serious engineer or scientist an opportunity to apply his skills in *flexible research areas* that range from conceptual realization to proof of feasibility.

Individuals with the proven ability to define and resolve complex problems in radar systems and techniques are invited to discuss how their previous disciplinary training and experience can be utilized in the following areas:

- CIRCUIT DESIGN
- ANTENNAS
- MICROWAVE COMPONENTS
- SIGNAL DETECTION THEORY
- RADAR DISPLAYS
- RADAR TRANSMITTERS & RECEIVERS
- INFRARED & OPTICAL DETECTION

To arrange an immediate confidential interview, please send resume to
Dana N. Burdette, Personnel Director

THE MITRE CORPORATION

244 Wood Street – Lexington 73, Massachusetts

A brochure more fully describing MITRE's activities is available on request.

SYSTEMS ENGINEERS

...to work in advance areas of Systems Planning, Development and Design for Missile Detection on a Global Scale

These positions are with the Missile Detection Systems Section of General Electric and require high technical and creative capacities. All assignments offer fruitful opportunities to make state-of-the-art advances with an organization that encourages and rewards the individual contributor. The ability to function both through individual action and team leadership is highly valued. Current openings are in these areas:

ADVANCED RADAR SYSTEMS PLANNING

Work in this area calls for engineers able to visualize and define future defense and space problems and conceive advanced radar systems to solve them.

RADAR SYSTEMS ANALYSIS & DEVELOPMENT

An advanced degree and/or strong background in systems analysis and design is essential for such assignments as:

... analyze and define requirements for advance detection systems and determine broader parameters for such systems; establish their feasibility.

... analyze long range missile detection systems and specify optimum configuration on the basis of utility, performance, cost and delivery.

SPECIALISTS IN ELECTRO-MAGNETIC PROPAGATION

PhD or MS is required in this area. Scientists will carry out analysis of propagation phenomena, as related to long range missile detection. Plan detailed investigations and illustrate practicability of results. Ability to assume responsibility essential.

OPPORTUNITIES IN D & D OF RECONNAISSANCE RECEIVER DESIGN & SYSTEMS EQUIPMENT

Assignments require specialized background in one or more of these areas: VHF and UHF frequency spectra (P & L bands) • ECM • Microwave; wave guide components, Duplexers, switches, hybrids; VHF and UHF transmitters.

ALSO POSITIONS IN COMPUTER APPLICATIONS

(Knowledge of large business or special purpose computers needed) and COMPUTER PROGRAMMING (experience with IBM 704 & 709 needed.)

Write in confidence to: Mr. James P. Kinsella, Div. 64-WC

Missile Detection Systems Section

HEAVY MILITARY ELECTRONICS DEPT.

GENERAL ELECTRIC

Court Street, Syracuse, New York

Achievement in Action at **Avco** *... for*

SCIENTISTS AND ENGINEERS

Achievement is habit at Avco! A leader in the field of atmospheric re-entry, Avco is now providing significant contributions to basic and applied research in Space and Missile Technology.

Supervisory, Senior and Junior positions are available in these areas:

- ELECTRONICS
- MATHEMATICS
- PHYSICS AND CHEMISTRY
- COMMUNICATIONS
- MATERIALS
- FLIGHT TEST ENGINEERING
- DESIGN ENGINEERING
- PRODUCT ENGINEERING
- AERODYNAMICS
- APPLIED MECHANICS
- THERMODYNAMICS AND HEAT TRANSFER

Attractive working environment outside of metropolitan Boston. The large, fully equipped, modern laboratory is close to Boston educational institutions and cultural events. The division offers a liberal educational assistance program for advanced study.

Forward your inquiry to:
E. W. Stupack,
Manager, Personnel Relations
Dept. AW7

Avco
Research & Advanced Development
201 Lowell St., Wilmington, Mass.

Martin Lacrosse Plays Deadly Game

Mobile as a chess queen, quick as a rapier thrust and as lethal as brass knuckles, the Martin Orlando Lacrosse is a handy weapon in a scrap. Developed, designed and built for the U. S. Army, the Lacrosse can flit like a ghost behind the battle area, fire in the general direction of the target and be pin-pointed by a forward guidance station.

The Lacrosse's ability to change its mind while in high velocity flight is another in the growing list of accomplishments by the men of Martin Orlando. Additional prime contracts include the Bullpup, air-to-surface missile, the Pershing, selective-range surface-to-surface missile and the Missile Master, electronic detection and control system for missile batteries.

Blue sky vision plus feet on the ground know-how has projected Martin Orlando to its place of leadership in electronics and missiles. Martin Orlando needs men with gray matter, the solid propellant needed to reach ever higher degrees of sophistication.

Immediate openings at senior level exist for Electronic Engineers, Physicists and Electrical Engineers in these areas: pulse circuitry, electronic packaging, transistor circuitry, electronic production test equipment, digital and analog computers. Also opportunities for men experienced in calculating solid state parameters, molecular distribution and quantum mechanics. Send confidential resume to: J. F. Wallace, Director of Professional Staffing, The Martin Company, Orlando 43, Florida.

MARTIN
ORLANDO

Ft. Sill, Okla.—The first two U. S. Army Battalions employing highly accurate Lacrosse surface-to-surface missiles were activated last month. Martin Orlando is supplying all the material required for the activation, including maintenance, training devices, launchers and missiles.

Key Positions open for

HIGH LEVEL ENGINEERS

MANAGER, DEVELOPMENT
CHIEF, AVIONICS
CHIEF, ASTRO-AERO SCIENCES
CHIEF, PRELIMINARY DESIGN
CHIEF, STRUCTURES

These five brilliant career openings are the result of the rapid expansion of Solar's Space Age R&D program. Current projects are exceptionally exciting and challenging, including an ARPA project for a completely new anti-missile defense system. Advanced degree preferred plus ten years experience in aircraft, missile and space flight fields. Learn complete details immediately.

SOLAR SPECIFICS

Solar is a medium-size company (2500 people in San Diego) with a successful history since 1927. Solar is making many significant contributions to space-age technology and the special professional status of engineers is fully appreciated and recognized. A new 60,000 sq. ft. engineering building, necessitated by expanding R&D work, will be completed this year on the edge of San Diego Bay. Solar also offers you the chance to live better in sunny San Diego. This famous resort area has the finest year-around climate in America and excellent cultural, educational and recreational facilities. You and your family will enjoy life more at Solar in San Diego.

SEND RESUME

Please send resume of your qualifications at the earliest opportunity to Louis Klein, Dept. E-417, Solar Aircraft Company, 2200 Pacific Highway, San Diego 12, Calif.

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

Exceptional openings for
ENGINEERS and SCIENTISTS
interested in
AIRFRAME STRUCTURES DESIGN

These outstanding openings offer engineers and scientists long-range career opportunities with Boeing, contractor on the Minuteman solid-propellant ICBM and the B-70 wing, and an industry leader in the field of advanced weapon systems.

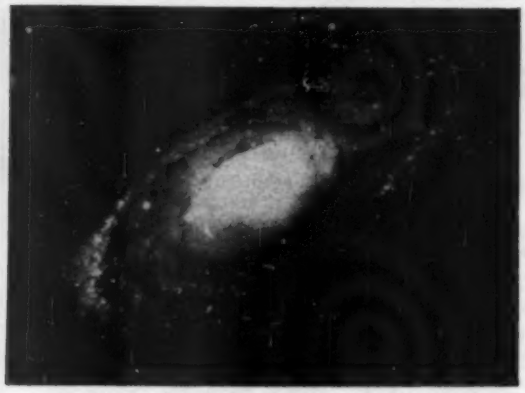
Assignments are in the over-all field of design of airframe structures capable of sustaining flight loads while exposed to extremely severe conditions of temperature, thermal gradient and thermal shock. Specific, challenging openings are available to qualified applicants interested in:

- Establishment of structural design criteria and objectives.
- Design of pressurized and unpressurized structures, including frames, bulkheads and control surfaces.
- Design of missile interstage structures.
- Design of major structure for advanced weapon systems involving new construction methods using brazing, welding, and honeycomb adaptations.
- Analysis and evaluation of the effects of stresses induced by thermal gradients across internal surfaces and between inner and outer surfaces.

For further details, write to:

Mr. Stanley M. Little
Boeing Airplane Company
P. O. Box 3822 - AVM
Seattle 24, Washington

BOEING
...environment for dynamic career growth



engineers • scientists

Explore Previously Uncharted Areas in ASTRODYNAMICS and AERODYNAMICS

The Applied Research & Development Division of Republic Aviation is making a multi-disciplined attack on the complex problems posed by advanced and unique flight vehicles. This expanding effort affords you the opportunity to apply your technical imagination and originality in the following areas:

ASTRODYNAMICS

- Space Vehicle Design
- Orbital Mechanics
- Interplanetary Flight
- Re-Entry Flight

AERODYNAMICS

- Missiles & Aircraft Aerodynamics
- Hypersonic Flow
- Physics of Rarefied Gases
- Strong Shock Phenomena

There's a growing atmosphere of technological excitement these days at Republic Aviation Corporation. Accelerating space study contracts plus a number of original proposals in such areas as ICBM's, air-to-surface ballistic missiles and unique aircraft are responsible for this environment that adds incentive for you to use your best thinking. The scope of challenge at Republic ranges from design concept to proof of feasibility. Working within a flexible framework of theoretical and experimental research, you will be able to define your own approach in attaining the requirements of your assignment.

For further information on these positions which combine scientific pioneering with career growth, address your resume to: Mr. George R. Hickman, Engineering Employment Manager, Dept. 1G-4.

REPUBLIC AVIATION
Farmingdale, Long Island, New York

MANAGER of ENGINEERING SALES

Outstanding opportunity to organize and direct technical sales programs. Experience in electronics, missiles, or aircraft required. Military liaison experience desired.

MR. C. H. WELLING
Director of Sales

P-2165, Aviation Week
Class. Adv. Div., P. O. Box 12,
N. Y. 36, N. Y.

MARTIN
BALTIMORE

Computer Applications

SENIOR STAFF SPECIALIST

HONEYWELL'S Aeronautical Division invites qualified candidates to consider this Senior staff appointment

POSITION Senior Staff Specialist for computer applications. Will operate independently with minimum guidance, must plan own activities and will be responsible for constructive relevant and technically sound recommendations. Opportunity to pursue appropriate advanced technical ideas.

RESPONSIBILITIES Recommendations regarding new techniques and technical trends, participation in concept and design reviews, liaison with military customers, other companies, and other divisions and departments within Honeywell. General top level technical consultation, program recommendations, evaluation of technical support requirements. Seminars in advanced problems of computer application.

REQUIREMENTS Strong background in analog and digital computer design through fire control, bombing, navigation and/or data processing system development. First hand computer circuit and control system design experience. Technical project direction with emphasis on system engineering

If interested in this staff opportunity, write
J. R. Rogers, Chief Engineer, Preliminary Development Staff

Honeywell

AERONAUTICAL DIVISION
2600 Ridgeway Road, Minneapolis, Minn.

IN ALL INTERESTS OF AVIATION
If You're Important, you either read
AVIATION WEEK
or you advertise in it, or both

ENGINEERS come to Minnesota

. . . land of rewarding opportunity for you — and your family

Ever lived in Minnesota? It's beautiful—and unhurried. Here in Minneapolis, for instance, many of our engineers live in resort-like settings only 15 minutes from work and within easy walking distance of one of our 23 lakes and 16 golf courses. A short drive takes them into wooded areas where they'll soon go hunting for pheasants, ducks, geese and deer.

Our people have time and opportunity for varied cultural and social activities too. We have a fine school system with a low pupil-teacher ratio—and the University of Minnesota. We have a world renowned Symphony—and excellent art centers.

You should be here with your family. And you can be—as a top level engineer with the Mechanical Division of General Mills. You'll work on the nation's most current and vital defense and industrial projects.

You'll be associated with recognized leaders in fields of advanced technology. You'll be equipped with modern laboratories and equipment. And you'll enjoy long-range security with one of the nation's most stable companies.

ONE OF THESE ENGINEERING POSITIONS COULD BE OPEN TO YOU RIGHT NOW

SYSTEMS ENGINEER to supervise senior level technical personnel in engineering development.

PROJECT MANAGER for electronic countermeasures development project.

SENIOR LEVEL ELECTRICAL OR OPTICAL ENGINEER for advanced engineering analysis and design of military reconnaissance systems.

SENIOR LEVEL ELECTRONIC ENGINEER for creative development of guidance and navigation systems.

SENIOR LEVEL ELECTRONIC ENGINEER for advanced engineering in electronic pulse and transistor circuit development.

ELECTRICAL ENGINEER OR MATHEMATICIAN to do logical design on special purpose digital computers.

PROJECT ENGINEER for electronic product design of missile instrumentation and radar systems.

DEVELOPMENT ENGINEER to perform reliability analysis and prediction.

If you have from 3 to 5 years experience in any of the above fields we'd like to tell you more about opportunities with General Mills. Send today for all the facts. We'll keep your inquiry in strict confidence.

G. P. Lambert, Manager Professional Employment

MECHANICAL DIVISION
2003 E. Hennepin
Minneapolis 13
Minnesota

General Mills

VTOL

AERONAUTICAL ENGINEERS

Unusually interesting design and development positions available in:

AERONAUTICAL ENGINEERS
AERODYNAMICISTS
STRUCTURAL ANALYSIS ENGINEERS
SYSTEMS ENGINEERS
ENGINEERING DRAFTSMEN

For immediate work on New Prime VTOL Aircraft Development Program.

Send resume to:

DOAK AIRCRAFT CO., INC.
22309 So. Western Ave., Torrance, Calif.
Attn: Mr. N. E. Nelson, Chief Engineer

DOAK AIRCRAFT CO., INC.

Corporate Pilot

We are seeking pilot, for a Cessna 310, with a minimum of 4000 hours and fully competent to handle high density area IFR flights. This assignment will not require full time flying, therefore, other duties will be assigned depending experience and background to provide full time regular employment.

Give full details of flying experience and previous employment in your reply.

Replies to:

Dr. G. A. Downsbrough, President
Boonton Radio Corporation
Boonton, New Jersey

ELECTRONICS EXECUTIVES

A nationally known California engineering organization needs additional engineering strength in the electronics field, because of recent expansion and continued diversification. They need engineers with demonstrated technical competence and leadership ability. These men are experienced in R & D guidance and controls with emphasis on electromechanical systems for extreme environmental conditions.

CHIEF ELECTRONICS ENGINEER

Support organization executives in management of electronic controls development. Should be experienced in electronic controls design and development.

SYSTEMS ENGINEER

Requires a project engineer experienced in guidance and controls with one of the missile prime contractors.

Write in confidence to:

William B. Avery & Associates
Management Consultants
936 Huntington Drive **San Marino, California**
ATlantic 4-4590

To EMPLOYERS Who Advertise for MEN:

Frequently, when there are many applicants for a position, only the most promising letters are acknowledged. The other applicants never know whether their letters reached a prospective employer or not. These men often become discouraged, will not respond to future advertisements and even question their bona fide character.

Every Advertisement Printed in the Employment Section Is Duly Authorized.

You can help keep our readers interested and get better returns to your advertising in this section if you acknowledge each reply—in plain envelopes, if you wish.

Classified Advertising Division

McGRAW HILL PUBLISHING CO., INC.

"Put Yourself in his place."

ADDRESS BOX NO. REPLIES TO: Box. No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Helicopter—Pilots and Mechanics. Leading Company needs pilots with a minimum of 750 Helicopters hours. Also licensed A & P's with Helicopter Maintenance experience. For full information write Rotor-Aids, Inc., P. O. Box 1850, Ventura, California.

Production Manager for Aircraft instrument Shop, doing mfg. & overhaul work. All inquiries kept confidential. Karnish Inst., Inc., Lock Haven, Pa. P-2056, Aviation Week.

A Western Canadian Aircraft Maintenance Centre requires the services of a "top" qualified aircraft communications and radio navigation systems technician to organize and operate a Radio shop, capable of providing the finest electronic, maintenance and installation work. The applicant chosen must be thoroughly experienced on all types of aircraft equipment, including auto pilots and weather radar, and possess a pleasant personality. Reply giving full details of experience and starting salary expected to: P-2131, Aviation Week.

POSITIONS WANTED

ATR SMEL Successfl. sales/mgt Bckgrd. Desires Exec/sls pilot-future. Single 30. PW-2108, Aviation Week.

Company Flight Crew—Pittsburgh company discontinuing flight operations. Highly qualified ex-airline captain and co-pilot available. Rated in most business aircraft up to DC 7. Write or wire Executive Director of Personnel PW-2153, Aviation Week.

ATR Pilot Age 37—10,000 hrs. Recently completed scheduled international contract. DC-3 DC-4 C-46 Desires flying position. PW-2164, Aviation Week.

BUSINESS OPPORTUNITY

Research & mfg. Co. desires financial assistance on outer space project. Have answer to interplanetary travel. Our patent pending; experiments and latest project will prove this. BO-2148, Aviation Week.

WANTED

Airplane Wanted: Twin Bonanza 6 months lease. If option to buy offered, sate option price after lease expires. Replies: Safe Flight Instrument Corp., 4 Water Street, White Plains, New York.

What is *your* problem?

Competent men for your staff? . . . employment? . . . or are you looking for—or offering—a business opportunity of special interest to readers of this publication? You can get their attention—at small cost—through an advertisement in the Employment Section of AVIATION WEEK.

PROFESSIONAL PERSONNEL REQUISITION

CONTROLS ENGINEERS

Marquardt's Controls and Accessories Division has established a position of leadership in the field of power system controls. Developing controls with high reliability; fast, precision response and extreme environmental capabilities provides challenge to creative engineers. If you have appropriate education and experience, investigate these job opportunities.

CONTROLS DESIGN—To create components for pneumatic and hydraulic control systems. Work ranges from simple piston actuators to complex speed computing devices. All designed for high sensitivity, fast response, extreme environmental conditions and light weight. Should be experienced in machine design and have an understanding of basic design analysis.

CONTROLS ANALYSIS—To investigate aircraft and missile control problems through the application of analysis methods in mechanics and dynamics, heat transfer, compressible flow, and servomechanisms. Position offers opportunity for creative engineering.

CONTROLS DEVELOPMENT—Opportunity to create workable controls components. Must have a "feel" for hardware and desire to undertake broad engineering responsibility. Opportunity to solve "on-the-spot" engineering problems utilizing pneumatic and hydraulic control analysis techniques.

For additional information, please write:
Mr. Floyd E. Hargiss, Manager
Professional Personnel, Dept. A-9
Marquardt Corporation
16555 Saticoy Street
Van Nuys, California

THE Marquardt CORPORATION
Van Nuys & Pomona, California—Ogden, Utah
Subsidiary: Cooper Development Corp., Monrovia, Calif.

Long Range Technical Planning

HONEYWELL'S Aeronautical Division offers a professional opportunity on its Advanced Systems Planning Staff.

This division has major contracts for guidance, instrumentation and automatic control systems for space vehicles, missiles, drones and aircraft with NASA and each of the military services.

The man selected will participate in determining the future program of the division in the same fields and in new systems and product fields. He will identify areas of opportunity arising from military planning and civil aviation requirements, and will recommend programs for capitalizing on these opportunities.

The man will have strong experience in operations analysis for weapons systems, in research or development of complex automatic control systems and/or in technical direction of such programs as a member of military agency or prime contractor. His technical specialty may include navigation, tracking, detection, fire control, bombing or communications with an appropriate academic background.

If interested in this staff opportunity, write
J. F. Healey, Director of the Advanced Systems Planning staff

Honeywell

AERONAUTICAL DIVISION
Dept. C, 1433 Stinson Blvd. N. E.
Minneapolis, Minn.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

DISPLAYED RATE:

The advertising rate is $31.00 per inch for all advertising appearing on other than on contract basis. Contract rates on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

UNDISPLAYED RATE:

$2.70 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $2.70 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

Send NEW Ads or Inquiries to Classified Adv. Div. of Aviation Week, P. O. Box 12, N. Y. 36, N. Y.

NOTICE OF SALE

Douglas DC-6 (YC 112A) Aircraft exclusive of engines attached but with four Pratt and Whitney R-2800-34 aircraft engines and four spare Pratt and Whitney R-2800-85XA aircraft engines.

To be sold to highest and best bidder pursuant to court order, 11 A.M. July 31, 1959, south door of Federal Building, 300 N.E. 1st Ave., Miami, Dade County, Fla.

For further information contact:

G. Hugo Whitehouse,
Special Master
501 Ingraham Bldg.,
Miami 32, Fla.
FR 4-4210

AERO COMMANDER-680

One owner manufactured August 1956. Total Time 1100 Hours; Modified Engines; Seven Place. Relicensed March 1959. Custom Radio including ARC-210 Transceiver, Dual ARC Omni's, Dual ADF's, L-2 Auto Pilot. Fully instrumented, many extras. $66,500. Terms.

***Inquire,* Atwood Vacuum Machine Co.**
Rockford, Ill.

WHERE TO BUY

Featuring additional products, specialties & services for the aviation field

A. B. MURRAY CO. INC.

EST. 1945

AIRCRAFT
STAINLESS STEEL
TUBING FROM STOCK

Elizabeth, N. J. • Bristol, Pa. • McKeesport, Pa.

R-2800 CB16 — Fully Overhauled — ENGINE WORKS — LAMBERT FIELD ST. LOUIS — R-2800 CB16

FOR SALE

Truck Mounted Air Conditioner

For Aircraft Heating—Cooling—Ventilating

Unit on 1959 Int'l. Harvester A-132 Chassis with BD-264 Engine and Power Takeoff.

Cooling with Carrier 35-Ton Compressor 3800 cfm air 12" External SP. Aircooled Condenser.

Heating with Janitrol 500,000 btu gasoline heater 2250 cfm air, 12" External SP.

With 25 ft. 12" ID insulated flexible duct.

Above unit a new production prototype being offered at fraction of original cost. Available for inspection and demonstration.

CONTACT
Hussmann Aircraft Division
819 E. Taylor Ave., St. Louis 15, Mo.

FOR SALE

IMMEDIATE DELIVERY

North American

AT-6's—T-28's—B-25's

Douglas	Boeing	Twin Beech
B-26's	B-17-G's	C-45-H's

THOMPSON AIRCRAFT SALES

2626 E. Washington St., Phoenix, Arizona
Phones BR 5-5479 or 5-9297
"World's Largest Dealers In Surplus Military Aircraft"

Searchlight EQUIPMENT LOCATING Service

NO CHARGE OR OBLIGATION

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate surplus new and used aviation equipment. Not currently advertised. (This service is for USER-BUYERS only) No charge or obligation.

How to use: Check the dealer ads to see if what you want is not currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o Aviation Week
Classified Advertising Division
P.O. Box 12, N. Y. 36, N. Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service,
c/o Classified Advertising, AVIATION WEEK
P. O. Box 12, N. Y. 36, N. Y.

Please help us locate the following equipment:

.....

.....

.....

NAME ..... TITLE.....

COMPANY .....

STREET .....

CITY ..... ZONE.... STATE.....

7/20/59

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, JULY 20, 1959

AERONCA MANUFACTURING CORP. 12
AERONUTRONIC, A DIV., OF FORD MOTOR CO. 84-85
AIRCRAFT RADIO CORP. 88
AVCO CORP., CROSLEY DIV. 7
AYER & ASSOCIATES, FREDERICK B. 101

BARDEN CORP., THE 24
BEKEY DIV. GENISCO, INC. 77
BELL HELICOPTER CORP. 14
BENDIX PACIFIC ELECTRONICS DIVISION, BENDIX-AVIATION CORP. 16
BENDIX RADIO DIVISION, BENDIX-AVIATION CORP. 78
BETHLEHEM STEEL CO. 16
BLISS CO., E. W. 75
BOEING AIRPLANE CO. 100
BRISTOL SIDDLEY ENGINES, LTD. 48-49
BRUSH INSTRUMENTS, DIV. OF CLEVITE CORP. 96

COLUMBUS DIV., NORTH AMERICAN AVIATION, INC. 4, 95
CONVAIR FORT WORTH DIV. GEN. DYNAMICS CORP. 102

DELAVAN MANUFACTURING CO. 52
DEUTSCH CO. THE, ELECTRONIC COMPONENTS. 94
DIT-MCO, INC. 55
DONNER SCIENTIFIC CO. 11
DOW CORNING CORP., SILICONES 90

ESSO EXPORT CORP., AVIATION PDTS. 46

FLIGHT REFUELING INC. 57

GENERAL PRECISION LAB., INC. 13
GOODYEAR AIRCRAFT CORP. 3

HALOID XEROX INC. 98
HI-SHEAR RIVET TOOL CO. 6
HYATT BEARINGS DIV., G.M.C. 9
HYDROMATICS, INC. 22

JACK & HEINTZ, INC. (AVIATION) 10

KAYNAR ENGINEERING CO. ..... 2nd Cover
KOPPERS CO., INC. 40

LABORATORY FOR ELECTRONICS, INC. ..... 3rd Cover
LEAR, INC. 90-91
LIBRASCOPE, INC. 89
LOCKHEED MISSILES & SPACE DIV. 99
LUKENS STEEL COMPANY 82

MINNEAPOLIS HONEYWELL REGULATOR COMPANY 58-59
MOOG SERVOCONTROLS, INC. 54
MOTOROLA, INC., MILITARY ELECTRONICS DIV. 71-73

NATIONAL UTILITIES CORP. 101
NEW HAMPSHIRE BALL BEARINGS, INC. 81
NORTH AMERICAN AVIATION 90-91, 113
NORTHROP AIRCRAFT, INC. 76

PACIFIC AIRMOTIVE CORP. 67
PARKER SEAL CO. 17
POLY INDUSTRIES 84-85
PRATT & WHITNEY DIV., UNITED AIRC. CORP. .. 5

RADIO CORP. OF AMERICA 20
RAYTHEON MANUFACTURING CO. 104
RESISTOFLEX CORP. 113
REX CORP. 79

SEARCHLIGHT SECTION 103-112
SENSENICH CORP. 75
SIKORSKY AIRCRAFT, DIV. OF UNITED AIRCRAFT CORP. 8

TELEFLEX INC. 93
TELECOMPUTING CORP. 65
TEXAS INSTRUMENTS, INC. 80
THERMO ELECTRIC CO., INC. 77
TITEFLEX, INC. 62
TWIN LOCK, INC. 36

U.S.A.C. TRANSPORT, INC. 92

VAPOR HEATING CORP. 74
VARIAN ASSOCIATES, TUBE DIV. ..... 4th Cover

WESTERN DESIGN & MFG. CORP., DIV. OF U. S. INDS. 15

YUBA CONSOLIDATED INDUSTRIES, INC. 67

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 105-111

EQUIPMENT (Used or Surplus New) For Sale 112

WHERE TO BUY Murray Co., Inc., A. B. 112

ADVERTISERS INDEX

Atwood Vacuum Machine Co. 112
Avco Research & Advanced Development 108
Avery, William B. 110
Boeing Airplane Co. 108
Boonton Radio Corp. 110
Doak Aircraft Co., Inc. 110
Engine Works 112
General Electric Co., Missile Detection Systems Section 106
General Mills, Inc. 110
Honeywell Aeronautical Div. 109, 111
Hussmann Aircraft Division 112
Marquardt Corp. 111
Martin-Baltimore 100
Martin-Orlando 107
Mitre Corp., The 105
Solar Aircraft Co. 108
Rommert-Werner 112
Republic Aviation Corp. 109
Thompson Aircraft Sales 112
Whitehouse, Hugo 112

RESEARCH AND DEVELOPMENT ENGINEERS AND SCIENTISTS

Exceptional opportunities in the field of thermodynamics.

At least five years experience or training required. Must have knowledge and understanding of theoretical, experimental work and ability to direct activities of engineers in the following areas:

Aerodynamics Heating of Aircraft Structures

Gas Dynamics of Real Gases

Thermodynamics—Engineering, Chemical, Statistical

Heat Transfer

Gaseous Radiation

Hypersonic and Space Vehicle Design

For more information please write to: Mr. A. G. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

THE LOS ANGELES DIVISION OF

NORTH AMERICAN AVIATION, INC.

FIREPROOF

...with Skydrol-resistant cover

Construction: Fluoroflex®-T tube, AISI Type 304 stainless steel wire braid, specially impregnated asbestos shield which resists hydraulic and cleaning solvent fluids. Dash 4 through –24Z with swaged type or Seal-Lock*reusable fittings. *Trade Mark

dept. 282 **RESISTOFLEX** Corporation, Roseland, N. J.

LETTERS

Sayen and Quesada

Bouquets to AVIATION WEEK for publishing Mr. Sayen's and Gen. Quesada's letters in the June 29 issue (p. 79). Gen Quesada's forthright answers to Mr. Sayen's accusations are, in my opinion, an example of the high standards that Gen. Quesada has set for himself and the Federal Aviation Agency. U.S. aviation needs men of Gen. Quesada's ability and integrity. We United States citizens and taxpayers should be thankful that Gen. Quesada was chosen to guide the Federal Aviation Agency through this difficult period of modernizing our woefully inadequate and antiquated aircraft control procedures. Kudos to Gen. Quesada for his intelligent handling of a difficult situation.

WILBUR L. COATS
Colorado Springs, Colo.

It is sad to think that such a well educated, independent, and professional group as our airline pilots must be represented by a violent one-sided partisan such as Clarence Sayen.

His public statements differ from a teamster local's rabble-rousing flyer only in Sayen's superior grammar. The presumption of innocence of all union members (remember his specious defense of the pilot who defied air traffic control and changed altitude in violation of his IFR clearance?), the reckless accusations and the general venom are all there.

A salute to Administrator Quesada who, with remarkable restraint and dignity, has shown the light of fact and reason on Mr. Sayen's tirade.

HENRY B. ROSE
East Hartford, Conn.

While your writer does not believe he holds all of the answers to the problems of safety in the field of aviation, but from time to time has owned six airplanes, has over 1,400 hr. first pilot time, a subscriber to your periodical since Vol. 1, No. 1, member of the Ohio Aviation Board the past five years, and cannot resist getting into the act with Mr. Sayen, the self-appointed spokesman of the gold-plated union, who reflects the truck driver's mind but very probably not the mind of most of those engaged in his occupation.

Unfortunately, there are those numbered among the airline pilots, resplendent in their blue uniforms with many gold stripes around the sleeves, who like to go back to the passenger cabin and permit the "unwashed" to fawn upon them and genuflect before such genius, forgetting entirely there are many other airplanes in the air that have a legal right to be there. While it is the duty of such others in the air to watch for Mr. Sayen's airplane, he seems to be unaware of any responsibility that he should watch for others. He reminds me much of the doting mother at military school who observed that her son was the only one in step as the class marched by.

While it is a long step from flying 450 hp. to getting into a jet airplane, Mr. Sayen didn't start out in a jet airplane and neither did anybody else, and those of us capable of making a living through means other than being a glorified chauffeur but who also possess the talent and some experience in the field of flying, seem to feel Mr. Sayen's position can be met through his frequent necessities to go to the passenger cabin by making the duration of his flight something less than 12 hr. at a stretch, then let him sit tight while he performs the duties for which he is being paid approximately $25,000 a year. Perhaps, too, if Mr. Sayen is suffering from such disfunction of the kidneys as requires so many trips to the passenger compartment, his qualifications to remain as a pilot should be reviewed.

As the courts of our land have so often said, "The danger to be perceived defines the duty to be obeyed."

JAMES C. BAGGOTT
Attorney at Law
Dayton, Ohio

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Editorial Position

After a number of years reading through the pages of AW, I am unable to decide whether AW is pro this or pro that or anti this or anti that. Actually I strongly suspect that AW is none of these (Clarence Sayen's views to the contrary notwithstanding).

Congratulations to AW and to George Baker. To AW for its forthright editorial policy based on fair and factual reporting; to George Baker for his forthright and factual statement before the New York Society of Security Analysts (AW June 29, p. 33), a statement that has long waited to be voiced by a man of his position in the air transport industry.

CLAUDE COAKLEY
Trevilians, Va.

Life Valued

Re Kenneth L. Dean's letter (AW June 15, p. 118):

1. Mr. Dean consistently ignores the times you have stuck up for the airlines.

2. He also ignores engine facts which science students are well acquainted with before finishing college.

3. His letter is so emotionally charged that if this is his normal manner of handling difficulties, I would not wish to fly with him. When I fly I expect the pilot to be a mature individual. My life is valuable to me.

H. L. ELMAN
Brookline, Mass.

Contents Page

There is nothing that irritates me more than "the buried Table of Contents." You did an extraordinary burying job in your issue of June 22. It took me at least three minutes to find the Table of Contents on p. 67! I know the theory that lies behind this belated index, but I think there are more disadvantages than advantages. For example, I'm sure I couldn't give you the name of a single advertiser on pages 1 to 66, unless perhaps it were Linde Union Carbide who appears on p. 66—opposite the Table of Contents.

However, this is but a small point. You have a fine book and your editorials are the most!

GEORGE DASHNAU
Supervisor, Technical Publicity
Fischer & Porter Co.
Hatboro, Pa.

Hard Missile Bases

In reading your magazine I have become increasingly disturbed by the increase in articles on "hardening" and "hard" missile sites. This is not criticism of your coverage but rather grave concern that this philosophy is becoming strongly entrenched among the various agencies responsible for USAF missile development. The reason for my concern is this: a missile in a hole is not airpower, it is merely glorified coastal artillery.

To find support for my assertion consider the body of literature concerning airpower, from official USAF air doctrine to the writings of Douhet, Seversky and Mitchell, and try to recall airpower ever being separated from mobility. In many of the earlier writings, airpower was largely justified because of its mobility. Until such time as an airborne hole in the ground is developed, my assertion is supported by the most respected aviation writers and thinkers.

It is interesting to note, perhaps because of years of the "Maginot minds" and "high over-pressure heads" type of accusations, that the Army has stressed mobility in most of its missile systems and left "hardened" out of its vocabulary. Along this line, it is pertinent to point out that a road-based missile could move 240 mi. a day, a ship-based missile 720 mi. a day, while our hardened hole just sits there. This is the mobility of airpower?

The ALBM concept shows a trend back to airpower and is highly welcome and should be vigorously supported. However, the danger of the fixed missile is not past and will not recede until it is recognized that Atlas, Titan, Minuteman and their kin are in no way ultimate weapons or the most desirable, but only interim stages in the development of a missile firing, nuclear powered, airpower weapon system. The way to space is through the air, not into the ground. Let's hope that 10 years from now our inverted silos are filled with grain and our missiles are in aero-space where they belong.

CAPTAIN, USAF
San Francisco, Calif.

UNIVERSITY MICROFILM INC

Mission accomplished . . .

Because the nation's very existence may depend upon the reliability of our interceptor missiles, it is imperative that each and every component and equipment be tested thoroughly, accurately and dependably.

The reliability of the microwave components and equipment used in the Air Force's BOMARC Missile Ground Support System is safeguarded by production and field tests using LFE ultra-stable microwave oscillators and LFE microwave stability testers . . . instruments created and manufactured by LFE because the need for exceptionally high reliability existed. This is but one of many creative contributions to the nation's defense resulting from LFE *Leadership from Experience.*

LFE

Leadership from Experience

LABORATORY FOR ELECTRONICS, INC. 1079 COMMONWEALTH AVENUE • BOSTON

ENGINEERS: LFE offers outstanding employment opportunities in Navigation, Radar and Surveillance, and Computer Systems and Components.

UNIVERSITY MICROFILMS INC
STEVENS RICE GS H
313 N 1ST ST
ANN ARBOR MICH

FOR RADAR
AND NAVIGATION

VARIAN KLYSTRONS

AND WAVE TUBES

VA-87 B C

HIGH GAIN, HIGH POWER, HIGH EFFICIENCY

You get all three in a single Varian Klystron, as in the VA-87B or C. These tubes are stable amplifiers... power a wide frequency range without critical adjustments of operating voltages and magnetic focusing. Features include rugged integral cavities, easy "plug-in" installation... outstanding reliability and long life.

Varian Microwave high power tubes are available in a wide variety of power output and frequency ranges for use in Radar, Communications, Test and Instrumentation, and many are recommended for Seven Star Commercial Service. Over 100 tubes are described and pictured in our new catalog. Write for your copy.

VARIAN associates

PALO ALTO 2, CALIFORNIA

KLYSTRONS, TRAVELING WAVE TUBES, BACKWARD WAVE OSCILLATORS, LINEAR ACCELERATORS, MICROWAVE SYSTEM COMPONENTS